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METAL INDUSTRY
FABRICATION · ASSEMBLING · PLATING · FINISHING
VOL. 37, NO. 3 MARCH, 1939

The Research Program of The American Electro-Platers' Society

FOR THE past 10 years, the American Electro-Platers' Society has maintained one or more research associates at the Bureau of Standards, Washington, D. C., who have worked on problems of the electroplating industry. The money for this research work has been and is being contributed by the A.E.S. and industrial organizations which are either engaged in electroplating or which use electroplated articles.

It would be both expensive and wasteful for industrial organizations to engage in extensive research programs in electrodeposition on subjects of common interest which could be studied by one central research organization, at only a small cost to each contributor. Thus subscribers to the A.E.S. research fund, as well as all industry, have received the benefits of research work on "spotting-out", and have learned the relative protection which zinc and cadmium electrodeposits give to steel, and the thickness of nickel coatings required to protect steel. The protection of chromium deposits and multiple deposits of copper, nickel and chromium to steel have also been determined.

A study of nickel coatings on non-ferrous metals has been recently made and, at the present time, methods of testing coatings and the influence of the basis metal as well as the treatment of the basis metal, on the porosity of nickel coatings is being considered.

Research on the nickel and chromium plating of plumbing fixtures is about to be commenced and a sub-committee has been formed to guide the work.

To enable more effective testing and plant development of research projects, committees of three representatives from each of the 29 branches of the A.E.S. have been appointed. These committees have already started the practical investigation of the stripping of nickel deposits from steel by the use of sodium nitrate. In this way the plant adoption of laboratory developments can be accelerated and at the same time, difficulties attendant with their manipulation, which may be unnoticed in laboratory trials, will be readily discovered.

The research work for the years 1938-1939 has been under the direction of George B. Hogaboom, nationally known authority on electrodeposition, and a committee of prominent men from all branches of the electroplating industry.

We believe that the research program of the A.E.S. has fully repaid those who have contributed to its support in the past, and recommend its continued support by all branches of the industry, manufacturer, supplier and consumer.

On the Nature of Passivity in Stainless Steels

SINCE the first mention in the literature over 150 years ago by Wenzel and Bergmann, the phenomenon of passivity of metals has been subject to active controversy as to its nature and cause. The protective film theory advanced by Faraday, in 1836, is still regarded by many research workers today as a tenable explanation for the passivity of iron and other metals. This simple theory is that passivity of iron, for example, resulted from contact with nitric acid or other oxidizing agents because of the formation of a mechanically protective, relatively inactive, oxide layer. This theory has also been used to explain the passivity of stainless steel.

Unfortunately, apparently simple explanations for natural phenomena often do not withstand strict scientific scrutiny especially when the phenomenon concerned can be studied with different methods of approach. The recent isolation by Evans and coworkers of visible films on low-chromium iron alloys as an argument for passivity is controverted by the findings, for example, of Hittorf who was able to passivate chromium in iodide solutions and by Uhlig and Wulff who found by electrochemical measurements that chromium alloys can transform from the active to the passive state in the complete absence of molecular oxygen at a rate dependent on the presence of electrolyte solutions (NaCl) in contact with the alloy.

In addition, the last-mentioned authors were unable to detect by electron diffraction methods any oxide film formation on iron which had been subjected to passivation in nitric acid. An oxide film appeared only after the iron was exposed to air for 24 hours. Doubt was placed on the validity of Tronstad's optical measurements of films which suggested that films on passive iron were from 10 to 20 Angstrom units thick. The conclusions from electron diffraction studies are that if any film exists on stainless steel it would be an adsorbed gas film less than 10 A. thick.

Other observations which render the oxide theory of passivity for stainless steel questionable are: (1) that through analyses of the anodic corrosion products, the surface composition of stainless steel was found to be the same as the alloy, and (2) threshold potentials of halogens on stainless steel can be likened to decomposition potentials thus obviating the necessity for the assumption of an oxide film.

The most tenable explanation for the passivity of stainless steel, and other alloys, in the writer's opinion, has been recently proposed by Uhlig and Wulff. Sound explanations are given for the passivating action of oxidizing agents and the depassivating actions of hydrogen, acids and halogens without resort to an assumption of an oxide film formation with the exception of pure metals, such as aluminum and magnesium.

The theory, in brief, postulates that passivity results from electron sharing with other metals or elements. The electronic configurations of the outer atomic shells of chromium, for example, are $3d^5 4s$ and for iron are $3d^6 4s^2$. From a consideration of electron affinity, and energy in the active and excited states, it would be expected that electrons from iron would tend to transfer to chromium to occupy vacant energy levels. Thus the sharing of one electron of iron with chromium would result in passivity and since the 3d shell of chromium needs 5 electrons for a full shell of 10, five atoms of iron would be passivated by one atom of chromium. Experience proves this assumption, as between 13.4 and 15.7 weight percent of chromium, iron-chromium alloys become passive. In addition, active iron is in equilibrium with ferrous ions, and passive iron, with ferric ions containing one less electron.

It would not be fortuitous that there is also similar concordance with reasoning and fact with nickel-iron alloys and molybdenum-bearing stainless steels.

Equally lucid explanations using the electron sharing concept can be given for the passivating action of oxygen and oxidizing agents, and the depassivating actions of hydrogen, acids, salts and magnetic fields.

The theory of passivity briefly outlined is not intended to account for all types of passivity but it does appear to lucidly explain the phenomenon for alloys of the transition and pre-transition elements.

Some Reflectivity Relationships of Individual Metals to Electroplated Alloys

By Lionel Cinamon, Ch. E.

President, The Special Chemicals Corp., New York, N. Y.

LIONEL CINAMON

The author presents an ingenious study of the reflectivity of metals and alloys. By means of a reflectometer with selected wave-lengths of light, an investigation of the reflectivity of electroplated metals thruout the visible spectrum was made. An explanation, for example, of the blueness of chromium, the yellowish cast of nickel and the redness of copper is given. A method for matching of color of deposits is suggested and it has the advantage of permitting fixed standards to be maintained to allow comparisons at remote places or for future reference.—Ed.

Introduction

Much difficulty has been experienced in trying to match various deposits of alloyed metals and oxidized finishes with sample panels. In many cases, the finishes may tarnish and the sample panels themselves, therefore cannot be regarded as standards. This is made more difficult by the difference often observed in color when objects are viewed under different types of lighting. Numerous methods have been used in the attempt to obtain constancy in conducting visual examinations of plated or oxidized coatings. In some cases tissue paper is used to cast a dull white light upon the object from the overhead lighting, in other cases, ground glass is used with a white daylight bulb to get diffused light or colored screens may be put over the source of light. Due to these variables, it has been difficult to correlate research data on finishing, and the comparing of different colors at a distance without the use of sample panels is particularly difficult. A device which can be used to determine the type of light reflected by a specimen would, therefore, enable the exact matching of specimens for people located at remote distances and the preparation of specifications for future use. It also would overcome the serious disadvantage of the sample finish changing its color from day to day.

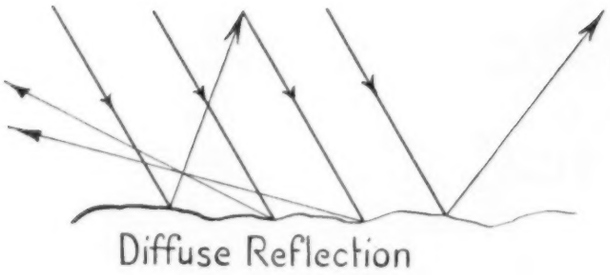
Any type of finish could, therefore, be given in a chart of the reflectivity of the various wave lengths of light and could be sent by telegraph or letter to any distant place and a perfect match would be made possible. Such apparatus would also permit the control of constancy of color of alloy deposits. Thus, the age-old problem of trying to match one brass electro-deposit with another could be simplified.

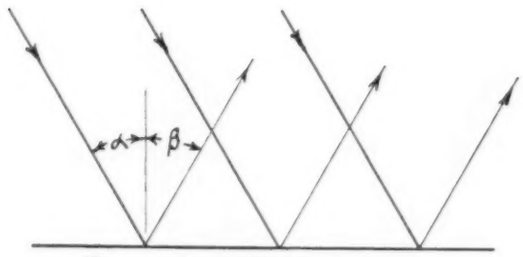
A study of the light reflected by various metals would explain the reason for chromium appearing blue; silver, white; and nickel, yellowish. It would also assist in the selection of metals for reflecting surfaces where specular reflection is required, and would serve as a suitable tool for the choice of metals to be used in heat reflection. It would be expected that if an electrodeposited alloy would reflect light over the entire visible wave length in the same manner as gold, for example, then this particular deposit should be non-distinguishable from gold from an appearance angle. This was one of the motivating factors in the study which follows and the success which was obtained in the duplication of a gold finish with a ternary alloy of copper, tin and zinc, is ample evidence of the value of this technique.

While investigating the electrodeposition of alloys in our laboratories, we also sought to learn in what manner the reflective properties of alloys might be influenced by the reflectivity of each constituent entering into its composition.

Types of Reflectivity of Light

Surfaces respond to light in three ways, namely: diffuse reflection, specular reflection and diffraction (Fig. 1). Diffuse reflection is caused by an uneven surface and is the reflection of light in all directions, while specular reflection is that of a smooth, plane surface throwing incident light back as reflected light so that the angle





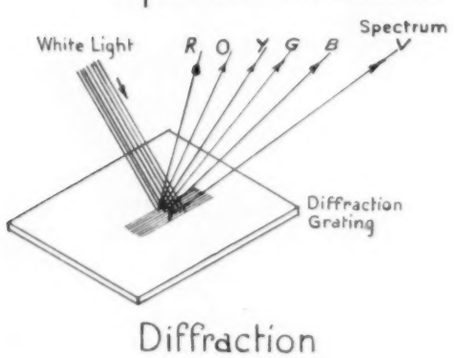


FIGURE I

Types of reflectivity of light.

of incidence is equal to the angle of reflection with the normal axis. Light thrown on a surface having fine, close, uniformly-spaced scratches will be dispersed into a rainbow of color, the spectrum. This effect is known as diffraction. A piece of metal with fine scratched rulings is known as a diffraction grating. An example in electroplating is that a scratch-brushed piece will often exhibit this phenomenon especially when a very thin lacquer coating is applied. (See Fig. 1.)

White light is not a single color, but is composed of red, orange, yellow, green, blue and violet components each in definite proportions. When the proportions vary, the color or shade that the eye sees, varies. When white light impinges upon a diffracting surface, the wave front is broken up and re-assorted so that we no longer see white light but the individual components.

In evaluating electroplates as reflectors, we are primarily interested in specular reflection, for the better the finish of the metallic surface, the less we have either disperse or diffractive reflection, until at the attainment of a perfect surface these reflections reach zero value and that of specular reflection reaches its highest value.

The eye is more sensitive to certain colors of the wave band, being more sensitive to reds, oranges and yellows than to the greens, blues or violets. There seems to be a peculiar relationship between what is commonly known as the warm colors, such as red, orange and yellow and the cold colors, such as blue, violet and green towards sensitivity of the human body. It is known that a copper reflector, high in red, orange and yellow reflectivity, reflects more heat than a chromium or any other white reflector. We, therefore, see that there is a close relationship between the sensitivity of the eye and the sensitivity of the body. On one side of the rainbow are the reds and infra-reds, and on the other side, the violets and the ultra-violets.

Another peculiar relationship can be demonstrated by the fact that when a white, blue or green light is thrown upon fog, smoke or any other form of dispersed particles, the penetrating value is very low, instantly producing a glare which prevents eye response from going very far into the dispersed medium. On the other hand, red, orange and yellow lights have a higher penetrating value and these beams are, therefore, widely used for this kind of work.

A practical application is the use of the amber fog lights on automobiles to obtain this higher penetration. From tests conducted in our laboratory, a plate having a high spectral reflectivity in the red and orange part of the spectrum will do a better job when used as a reflector for fog or smoke penetration, than a white reflector with an amber lens. Although the total white light reflectivity of copper

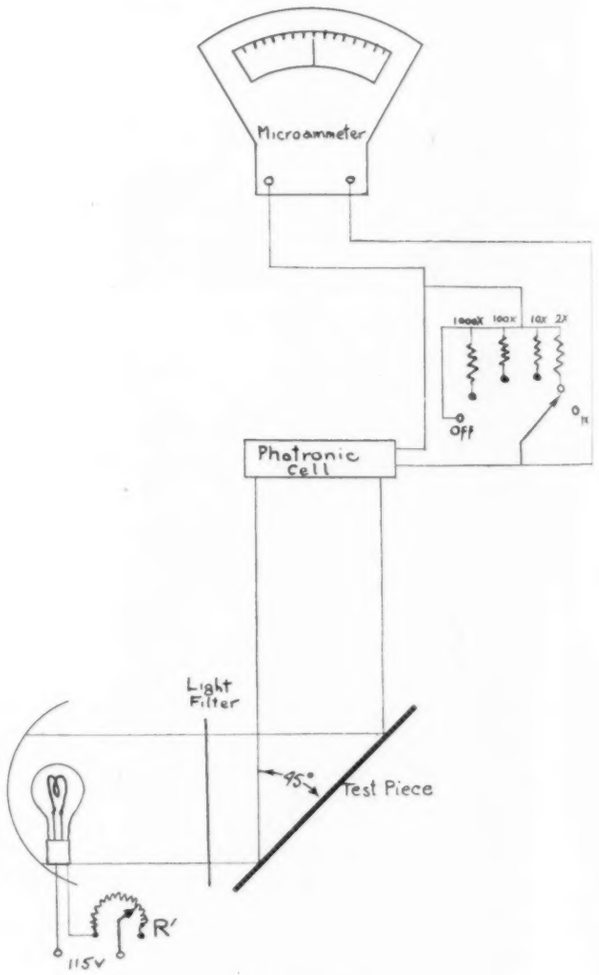


FIGURE II

Diagram of apparatus for measuring reflectivity.

and gold may not be as high as silver, it has a far higher penetrating value and color sensitivity to the human eye.

Of course, we realized that in the formation of definite metallic compounds, the properties are not predictable, but in the case of solid solution with very little or no compound formation, there might be good possibilities. Many alloys are in the latter class.

Construction of Reflectometer

It then became necessary, in some simple and quick way, to determine the relative effectiveness of various electroplates as reflectors of visible light.

In the simplest form, an instrument for measurement of specular reflection consists of a source of constant parallel light, the reflecting surface set at a 45° angle to the incident beam and a method of measuring the reflected beam. The parallel beam can be obtained by means of a reflector or by use of condensing lenses.

In our instrument, (see Fig. II) we use a reflector from an automobile spotlight with a 75 watt 115 volt Mazda bulb as a source of light. The intensity of the light source is varied by means of a rheostat. The test piece is held on a plane at a 45° angle to the incident beam. Between the light source and sample to be tested, we have placed a holder for light filters so that we can study the effect of various wave lengths of light. To measure the reflected light, we use a Weston Photronic cell. Its response to light is very similar to the human eye. The electrical energy produced in this cell is fed into a very sensitive microammeter. There are suitable resistances shunted across to act as multipliers of the instrument scale.

The light filters are Wratten gelatine filters, two inches square and mounted between glasses with Canada balsam. By referring to the booklet "Wratten Light Filters" published by Eastman Kodak Company, we drew a set of curves of the spectral transmission of each filter and by inspecting these curves it was possible to determine which filters to combine to give the sharpest spectral "cut-off". The "cut-off" was not as sharp as we would have liked it, and the filters therefore present a possible source of error. However, they were the best obtainable at the time.

Base Metal

Brass was chosen as the base metal upon which to electroplate, principally because of its suitability in being easily polished and plated. Plates two inches by three inches by 0.1 inch thick were cut down, polished and color-buffed until they all gave the same reading in the reflectometer. They were then given only enough plate to color completely, but did not deposit any appreciable thickness of electroplate. The reason for this is quite apparent when one considers how a deposit builds up becoming progressively less bright and rougher with continued plating; whereas a "flash" plate partakes of the nature of the surface upon which it is deposited. By so doing, we eliminated the necessity of buffing and thereby introducing a variable leading to possible erroneous readings.

In this manner, three plates each of a number of metals and alloys were prepared. Also specimens of zinc and aluminum were polished until the reflectometer readings were constant. While these were not electroplates, they were nevertheless taken for comparative purposes.

Silver was taken as standard and given a value of 100%. Every other plate was referred to silver and the reflectivity reported as a percentage of the reflectivity of silver.

Manipulation of Apparatus

The manipulation of the apparatus is quite simple. First the silver standard is inserted on the 45° plane and the light snapped on. The rheostat R is adjusted until the meter scale reads an arbitrary high value—50,000 was selected for white light (tungsten filament bulb). The silver standard is now replaced by the sample to be tested and the reading again taken. The per cent of reflectivity would then be the last reading divided by the reading of the silver piece times 100. The readings were taken with the various filters in turn, each filter or set allowing only a narrow band of wave lengths of light to impinge on the test piece. When the data were completed, a set of curves was plotted.

Some interesting results were noticed. But first let us see just what makes color in a plate. White light is composed of three primary colors; blue, green and red, and a large number of secondary colors. The absorption or partial absorption of a particular spectral region gives color.

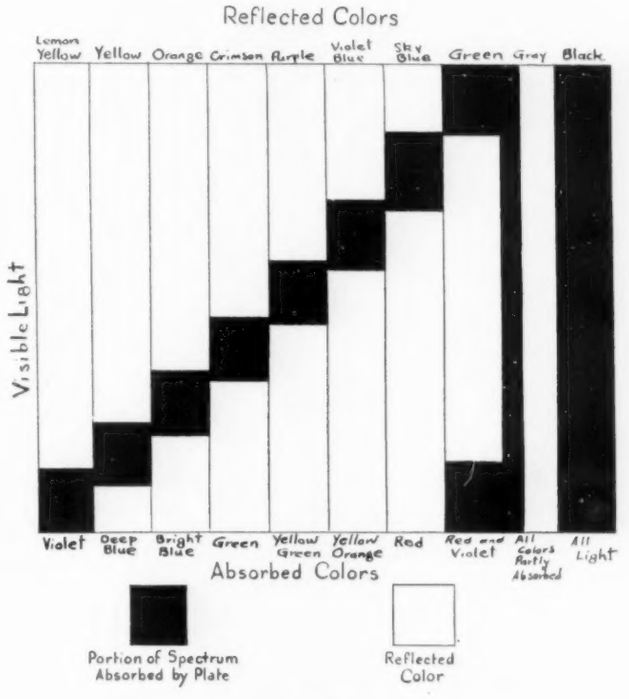


FIGURE III

Fig. III shows the color reflected (names at top of chart) when certain other colors are absorbed (names at bottom of chart.) At the right is shown the partial absorption of all colors to give gray and total absorption of all colors to give black.

We can see from the chart that if a plate completely reflected the two complementary colors at either end of each column, it would appear white even though it absorbed every other color. For example, if a plate reflected all the yellow and deep blue impinged upon it and at the same time absorbed all the rest of the visible spectrum, it would

be just as white as a plate reflecting completely green and crimson and absorbing the rest of the spectrum. However, if the total reflection of the complementary colors is less than 100%, some intensity of gray is produced.

The subject is further complicated by the fact that metals only partially absorb colors and reflect the balance of the spectrum. A good illustration of this is cadmium. (See Fig. IV). It is low in green having a deep depression at 5260A. There are two complementary peaks; namely, 4100A violet and 5740A yellow, 4600A violet blue and 5940A yellow orange, both giving white. However, the generally low white light reflection—79% makes cadmium a gray metal; that is a white of reduced intensity.

If a plate absorbs green and red to a greater extent than blue, or conversely, if a plate reflects blue to a greater extent than it reflects green and red, it appears blue to an observer. A good example is chromium. Note in Figure IV the peak in the middle blue at 4740-4810A, the depression in the middle green at 5200-5300A and again in the far green at 5580A. From there on, despite a slight lift in the curve at 5740A, the depressed area persists in the red and only rises to the infra-red, the heat band at 7000A and beyond.

The author wishes to express his grateful acknowledgment to Samuel Sklarew Ch.E., of the Special Chemicals Corp. for his able assistance in obtaining and organizing the data herewith presented.

(To be continued in April issue.)

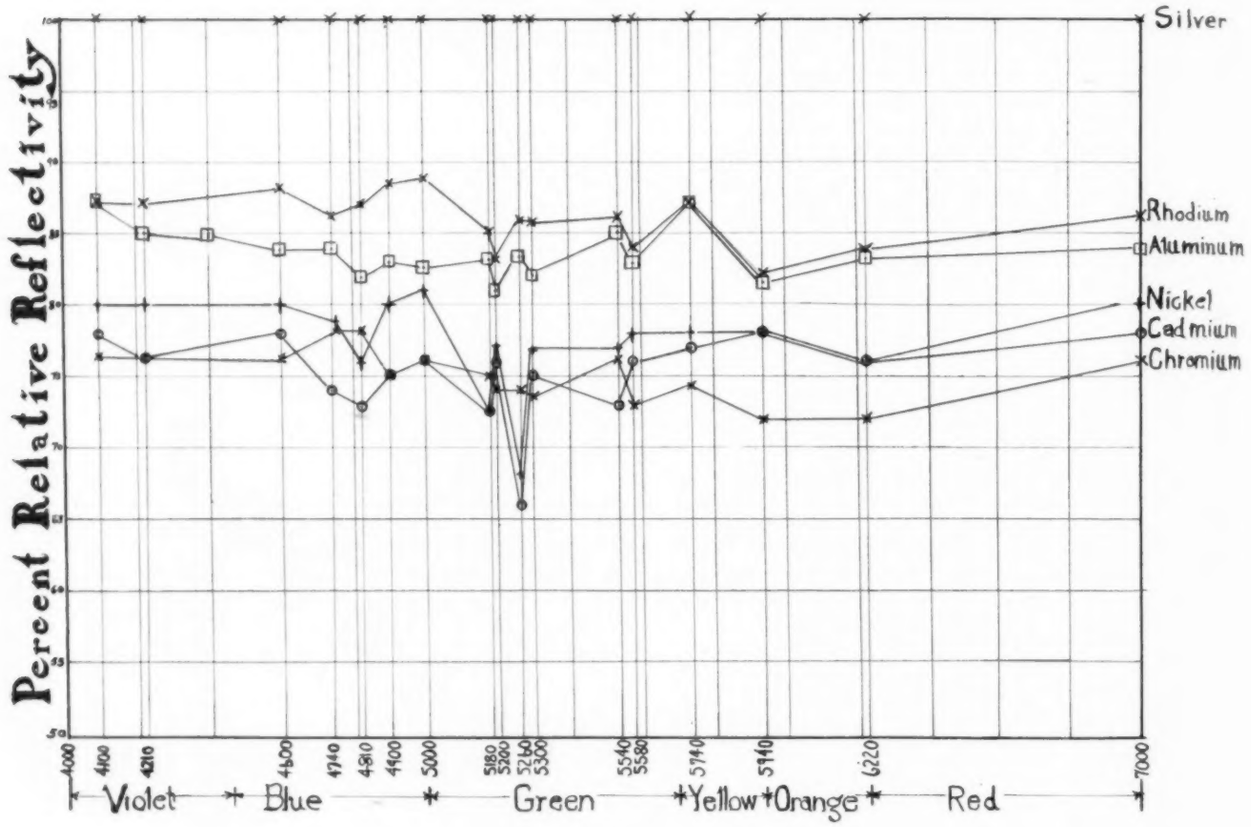


FIGURE IV

White Light Reflectivity

Reflectivity of silver, rhodium, aluminum, nickel, cadmium and chromium.

(75 Watt D.C., 115 Volt Mazda Bulb)

	Percentage Reflectivity
Silver	100
Aluminum	87
Rhodium	85.6
Cadmium	79
Nickel	79
Chromium	77

Centrifugal Lacquering

By E. Ingersoll

The production of adherent continuous lacquer coatings on small work can be done by centrifugal lacquering. Suggestions on the type of lacquer, its dilution and technique of centrifuging are given.—Ed.

WE ARE being continually confronted today with problems of production to successfully meet competition. We must develop new and more productive methods and materials in order to meet the demand. The activity taken in this field by the present day manufacturer is rapidly spreading. The trend is seen to be of benefit not only to the individual concern, with given problems, but to all industry. This is clearly seen in the metal finishing trade where we have made considerable progress the past few years through the co-operation and research of various manufacturers.

Great strides have been made recently by the manufacturers of lacquers and synthetic enamels in methods of application and development of new and better products enabling greater flexibility of use. It is quite probable that most of us will agree that we have, at various instances, been confronted by the problem of applying lacquer or enamel on certain products which, due to demand of production plus limited space and time, seem to be nearly insolvable.

One of the problems has been the successful application of lacquer to small parts where complete coverage is necessary. The conventional methods of dipping or spraying do not insure complete coverage except in special instances, and even then, we usually have a drying problem due to the parts being in a mass which necessitates breaking apart by force. During this breaking-up process, the surfaces that were in contact are marred, scratched or the coating is pulled away, thus often making the product unsaleable.

The method of placing the parts in a tumbling barrel and spraying while the work is in motion was given a trial but some difficulty was encountered. This was due chiefly to the poor adherence of the material used plus the tumbling action which rendered the surface unfit for use. By using a more adherent lacquer, this process produced a satisfactory finish if the parts did not require a high finish.

The problem now was to find a method by which parts of high lustre could be coated without materially affecting the degree of brightness. We might state at this point that the above-mentioned applications were accomplished with a nitrocellulose base material. The particular work being processed at this stage called for a hard and very durable finish.

The next step taken was to dry dip lacquering sample batches of the product followed by thorough drying in a centrifuge. On certain types and shapes of work, this was accomplished with a minimum of rejects. These parts consisted of screws, nuts, chains and other pieces, the surfaces of which were largely rounded or concentric. It was found that if the work was flat and each individual piece had no more area than one square inch, the parts could be lacquered in this manner with a minimum of sticking together but if, however, they went beyond this size, the sticking together persisted to a greater extent. Since this could not be tolerated, a method had to be found which would eliminate this condition.

The coating material to be used called for maximum adherence, flexibility, toughness, hardness and had to be of the clear colorless type. The final selection was a synthetic product found to be the most desirable for this particular job that was being partially dried in the centrifuge. A large amount of the success obtained in the application of lacquer in this manner was found to be in the speed of the centrifuge. If the speed was too slow for the type lacquer being used, the result was a heavy coating which scratched easily and had poor adherence. Then again, if the speed was too fast, the result was a hard, brittle film which flaked off at the lightest touch. The speed was adjusted to 1100 R.P.M., which seemed to be the best.

Centrifugal machine for lacquering small parts. Also used as a dryer.

(Courtesy Dellinger Mfg. Co., Lancaster, Pa.)

Two types of centrifuge baskets were used in each of the tests. Basket A was constructed of 0.0625 diameter iron wire, number 8 mesh, 18 inches in diameter by 8 inches deep with a three-inch sheet-iron flange placed around the top of the basket to prevent the work from flying out while the basket was in motion. A three-inch shaft spacing was

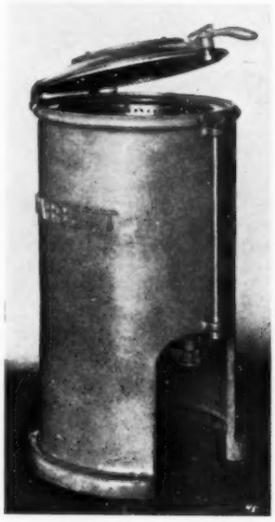
allowed in the center. Basket B was of similar proportions except the flange was 4" in diameter and constructed of mesh. This basket had vertical sides whereas basket A had tapered sides.

After many experiments with various densities of lacquer, the selection for greatest ease of application, appearance and greatest durability was made. It was thinned with a suitable thinner to a point which gave a reading of seventy degrees on a Tralle and proof hydrometer. The work to be processed was thoroughly dry and without stains of any sort. It was placed in nickel-chrome dipping baskets and given a dip, while vigorously agitating, (this will not scratch

Centrifugal lacquering and enameling machine.

(Courtesy Tolhurst Centrifugal Division, American Machine and Metals Inc., New York, N. Y.)

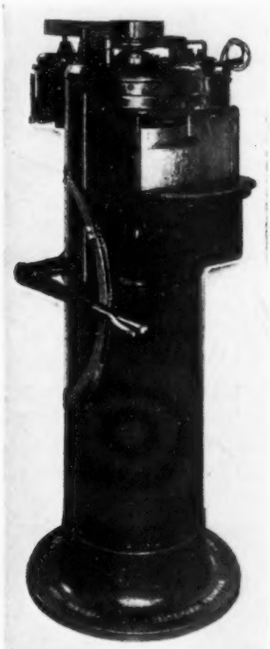
or mar the finish as the viscosity of the lacquer is such as to prevent this action). The basket was then allowed to drain over the lacquer container for one minute, after which it was emptied into the centrifuge. If the centrifuge is of such size as to accommodate more than one dipping basket of work, the first basket may be permitted to remain in the open centrifuge while the second is being prepared. Upon addition of the second basket, the entire contents of the drier are shaken so as to evenly distribute the load. The machine should be allowed to remain in operation for one minute when it should be stopped and the work thoroughly shaken again so as to separate any parts which may be adhering to one another. This operation is repeated twice before the contents of the machine are removed.



Centrifugal machine for lacquering.

(Courtesy Leon J. Barrett Co., Worcester, Mass.)

Upon removal from the baskets, the work is placed on heavy screens to a depth of two inches and placed in the oven. If the lacquer is of the correct type, the time in the oven should not exceed twenty minutes at 300°F. The oven must give a consistent temperature with good circulation or the lacquer will be burned to a yellowish cast. When removed from the oven, the trays of work should be placed in a cool dry atmosphere until thoroughly cool. Parts are now ready for inspection or assembly.



Whirl enameler.

(Courtesy Ronci Machine Co., Providence, R. I.)

Filtration of Electroplating Solutions

By Dr. Walter R. Meyer

Editor, Metal Industry

The main sources of porosity in electrodeposited coatings, which may be removed by filtration, are discussed. Deposits from unfiltered solutions are, in most cases, more porous than deposits obtained from filtered solutions. A review of the construction and use of filters for electroplating solutions, particularly filter presses, is given.—Ed.

Introduction

This is the concluding article of a series of articles on problems in filtration. The use of activated carbon[1], filter aids[2, 3] and the development of a commercial line of filters[4] for electroplating solutions have already been discussed.

The general adoption of the practice of filtration of plating solutions has been, in the opinion of the writer, unduly slow. This has been due to several reasons: namely, (1) the readiness with which many of the old-time filters became clogged necessitating frequent cleanings, (2) the low filtration pressures of the old-style filters, (3) inability to justify the expense of the filter itself and the labor of filtration due to the low work productivity of cold, low current-density plating solutions.

The present-day picture is quite different. The use of filter-aids has reduced the frequency of cleaning of the filter due to clogging and has aided faster filtration, higher pressure filters have been developed and the wider utilization of warm plating solutions, higher current densities, thicker deposits and automatic equipment has stimulated the practice of filtration.

Effect of Filterable Foreign Matter on the Porosity of Electrodeposited Metals

The effects of inclusions on heavy deposits have been considered by Cymboliste[5] and the writer[6] who showed that nodular, rough deposits may be caused by inclusions. The effects of filterable suspended matter on the porosity of nickel coatings have been recently discussed by Hothersall and Hammond[7]. The five main sources of suspended matter in nickel solutions are: (1) anode smut which may consist of carbon, metallic nickel, or nickel oxide, (2) precipitated compounds of iron (ferric hydroxide), (3) dust from air especially if the plating room is adjacent to the polishing room, (4) calcium sulfate from hard water (some waters may run as high as 500 parts per million of Ca^{++} calculated as $CaCO_3$ such as in the Chicago Heights district, and (5) lead sulfate from reaction with lead linings. In addition, scouring pumice or whiting, precipitated salts from poor rinsing and loose chips and particles mixed with the salts may be found in plating solutions.

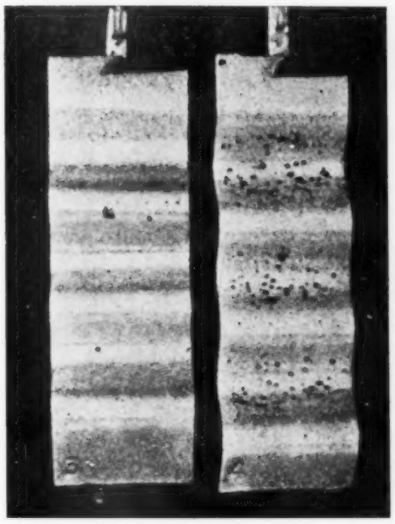


FIGURE I

Effect of suspended lead sulfate on porosity of nickel. Left, no lead sulfate; right, lead sulfate added to solution. After Hothersall and Hammond[7].

The effects of these particles are described by Hothersall and Hammond as follows: "If the particle settling on the cathode is electrically non-conducting (for example, precipitated compounds), or if the contact between it and the cathode is poor, the underlying metal will be shielded from the current and little or no deposit will be formed around the point of contact. The size of the particle and the time from the commencement of deposition at which it lodges upon the cathode surface will determine whether a pore is ultimately present in the deposit. A small particle, for example, will tend to be bridged over if deposition is continued for a sufficient length of time.

"Electrically, conducting particles in good electrical contact with the cathode are less likely to be a cause of porosity than particles which shield the basis metal from the deposit. They may, however, result in the ultimate presence of pores by (1) causing the formation of growths, around the base of which, discontinuities may be present because of the retarded rate of deposition in this area, resulting in a fissure which may extend to the root of the growth; *growths are also likely to be torn out during the polishing (buffing) process;* (2) acting as nuclei for the localized discharge of hydrogen gas which will prevent nickel deposition by the shielding action of the bubbles."

Suspended matter was shown to definitely increase the porosity of nickel coatings and filtration markedly reduced the number of pores. See Table (I).

Series F—The solution was filtered by suction thru a Buechner funnel using fine filter paper (No. 42 Whatman) and the anodes were well scrubbed and washed before being replaced.

Series FF—The solution was boiled with freshly precipitated nickel hydroxide and then filtered in the same way as in series F. The nickel anodes were replaced by lead anodes enclosed in porous pots.

It may be seen from these data that there is a marked decrease in the number of pores when the solution is filtered, and some porosity is due to particles from the nickel anodes. The effect of suspended lead sulphate is shown in Figure I.

TABLE I

THE EFFECT OF FILTRATION ON POROSITY OF NICKEL DEPOSITS[7]

Condition of Solution	Average Thickness of Deposit in.	mm.	No. of Specimens Tested	Average Porosity (No. of Pores per dm^2) Concave sides	Convex sides
Not specially filtered (Series NF)			5	30	9
Carefully filtered (Series F)	0.001	0.025	3	6.2	0.9
Not specially filtered (Series NF)			5	86	51
Carefully filtered (Series F)	0.0006	0.015	3	10	2.6
Not specially filtered (Series NF)			5	230	152
Carefully filtered (Series F)	0.0002	0.005	3	113	66
Specially filtered (Series FF)			9	32	25

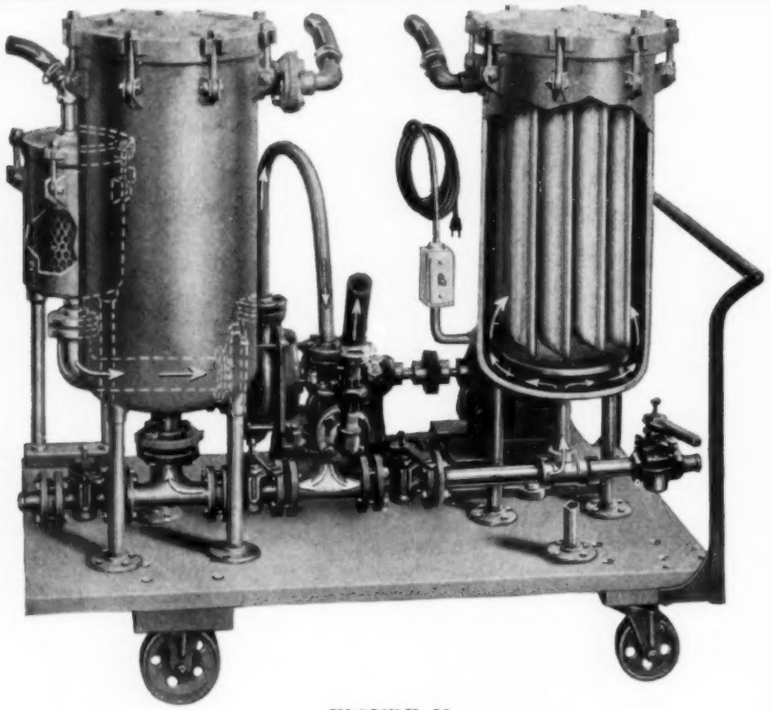


FIGURE II

Assembly as illustrated has two filter units; each a different model both mounted on one platform and operated from the same pump provides a combination filter with two separate filtering units; one for nickel and the other for cyanide.

(Courtesy Industrial Filter and Pump Mfg. Co., Chicago, Ill.)

Filters for Filtration of Plating Solutions

Enclosed Chamber-Baffle Type

A line of portable filters such as shown in Figure II is available to the plating industry. These filters consist of the necessary pumps and fittings and the filtration is done in a closed pressure chamber through canvas or other suitable material which is put around baffles. (See Figure III). These machines are made with from ½ to 2 H.P. and capacities from 125 to 1400 gallons per hour. The filter is easily cleaned and because of the large filter chamber and ample space between baffles, filter aids and activated carbon may be used and in fact are recommended. Filtration of all types of plating solutions is possible using the following materials with the respectively-mentioned solutions:

Horizontal Plate Filters

To facilitate the even distribution of filter-aids over the filtering plates, a series of filters have been marketed with the chamber construction as illustrated in Figure IV. The filter plates are nested on top of each other in a horizontal position and the filtering process is always straight downward. The filter cake lays, therefore, in a horizontal position and ample space is provided for a thick cake. The filters are interchangeable as powder, paper or asbestos disc filters. The filters are made of bronze, stainless steel or any metal desired and have capacities from 40 to 1000 gallons per hour.

Filter Presses

A filter press consists of the required number of individual filter chambers (see Figure VII) assembled into a self-contained unit. Each chamber is formed by a filter frame of the required thickness, on each side of which is a filter plate. These plates are covered with filter cloth which, besides acting as a clarifying medium, also provide a tight gasket joint between filter frames and plates when the filter is closed and in service.

The solution to be filtered is pumped into each filter chamber at the same time. The clear liquid passes through the filter cloth and out of the filter, all solid particles being retained in the filter chambers. When the cake in the filter chambers becomes too thick for rapid filtration, the filter is opened, the cake removed and the filter closed again for another cycle of operation. Cleaning is quickly and thoroughly accomplished.

The thickness of the filter frames

TABLE II

Type of Solution	Material for Baffles	Material for Filter Bags
Nickel (room temp.) Acid zinc	Cypress wood	Cotton cloth
Nickel (hot or bright) Acid (Zinc, Copper)	Cypress wood	Woolen cloth
Nickel (Some types of bright nickel) Acid (Copper)	Rubber covered steel	Woolen cloth
Cyanide (Copper, brass, cadmium, zinc, silver)	Steel	Cotton cloth
Chromium	Steel	Glass fibre cloth

(Courtesy of The Industrial Filter & Pump Mfg. Co., Chicago, Ill.)

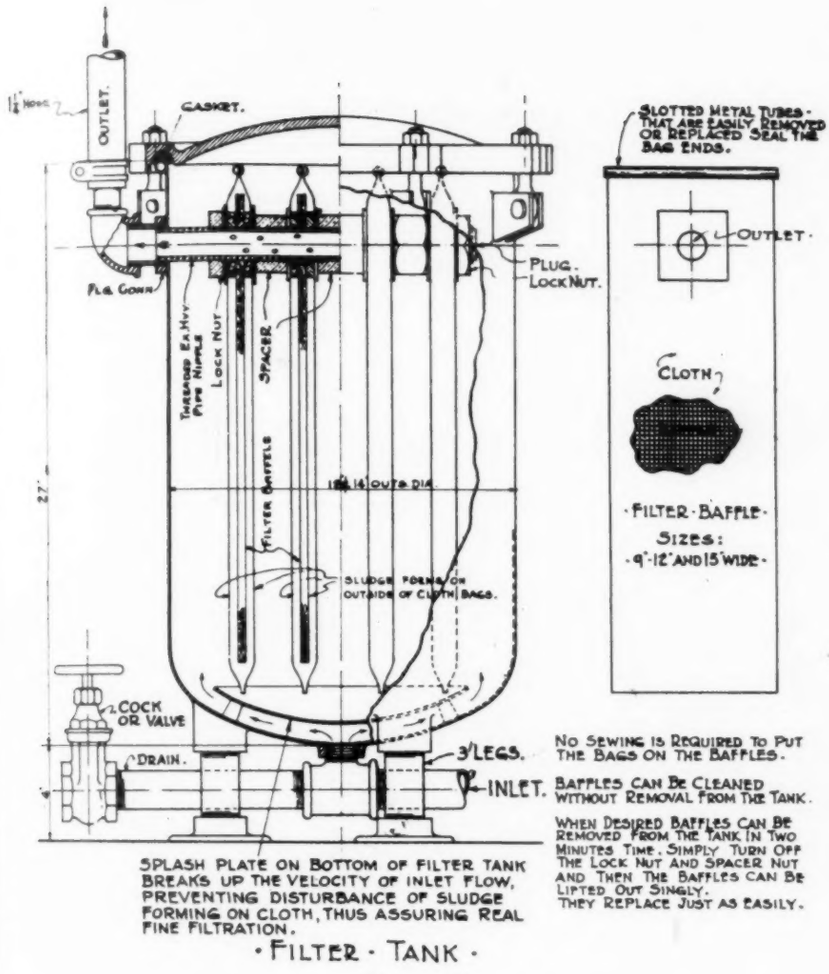


Figure III

Diagram of filter tank and baffle of chamber-type filter.

(Courtesy Industrial Filter & Pump Mfg. Co., Chicago, Ill.)

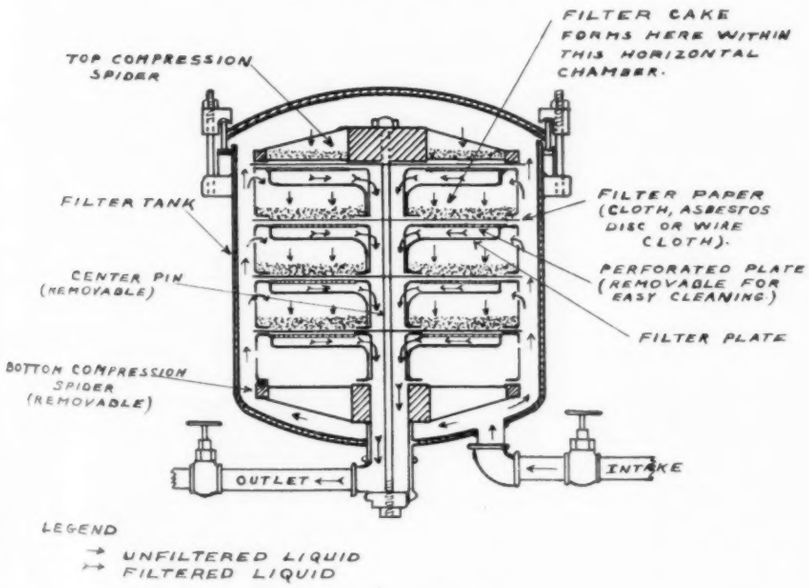


Figure IV

Horizontal plate filter chamber.

(Courtesy Sparkler Mfg. Co., Chicago, Ill.)

used is dependent upon the amount of solids in the particular solution being filtered and whether filter aid is to be used during filtration. When filter aid is used, the frame thickness should be at least 1" to allow for a heavy cake to form without cleaning of the filter.

Determining the Size of Filter to Use

To arrive at the correct size of filter it is considered good practice to figure on an average filtration rate of 20 to 25 gallons per hour per sq. ft. of filtering area. While in many cases, the initial filtration rate may be considerably higher than this figure, approaching 50 to 60 gallons per hour, the figures certainly do not represent the average filtration rate after the filtering medium has become coated with the suspended matter being filtered. The size of filter to choose not only depends upon the number of gallons of solution to be filtered, but also on the frequency of filtration of any definite volume of solution. Thus, for example, for a tank containing 1000 gallons of solution, complete filtration may be attained in one hour with a filter having 40 to 50 sq. ft. of filtering area, but if the same quantity of solution is to be filtered in four hours only 10 to 13 sq. ft. of filtering area is required.

Materials of Construction

The plates and frames of filter presses and other accessories which come in contact with the plating solution may be made of various materials, such as lead, cast iron, rubber-covered cast iron, wood, solid rubber and alloy steels. The materials to be used in filter presses are somewhat similar to those given in Table II for the en-

Figure V

Horizontal plate filter.

(Courtesy Sparkler Mfg. Co., Chicago, Ill.)

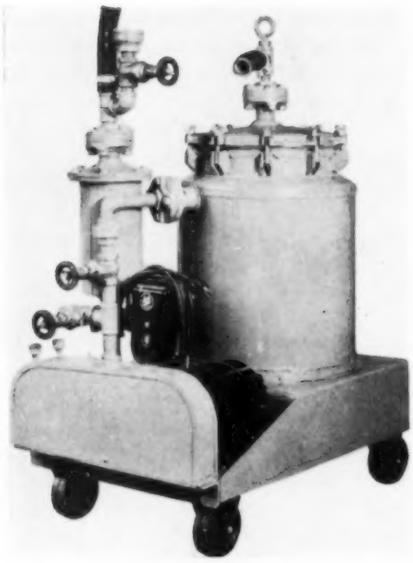


Figure VI

Modern multi-disc filter

(Courtesy The Belke Mfg. Co., Chicago, Ill.)

closed chamber-baffle type of filter, but it is recommended that the manufacturer be contacted for advice as to the materials to be used for any particular solution.

Pumps

One of the most vital parts of the filter press unit is the pump, and the diaphragm type pump has been found very satisfactory for handling corrosive solutions. While relatively more expensive than other types of pumps, it offers definite advantages in the handling of difficult fluids and usually more than pays for itself in longer life and lower maintenance cost. A commonly used diaphragm pump is a double-acting type, positive pressure

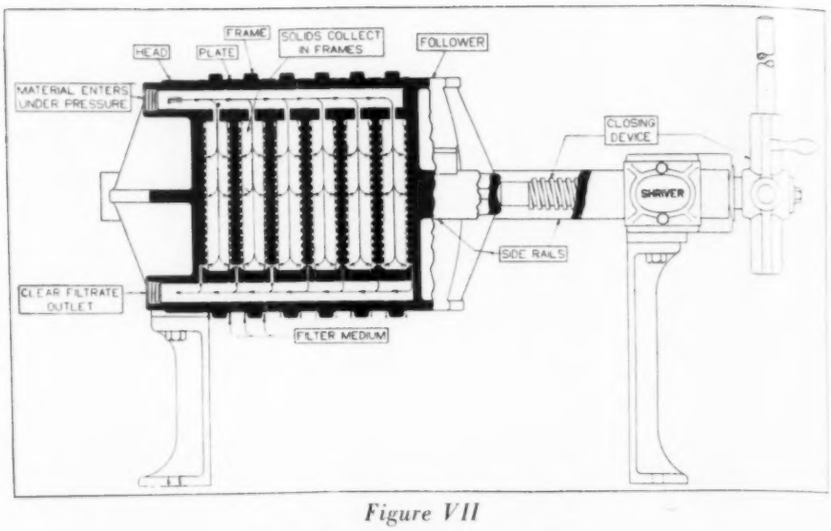


Figure VII

Sectional view of filter press.

(Courtesy T. Shriver & Co.)

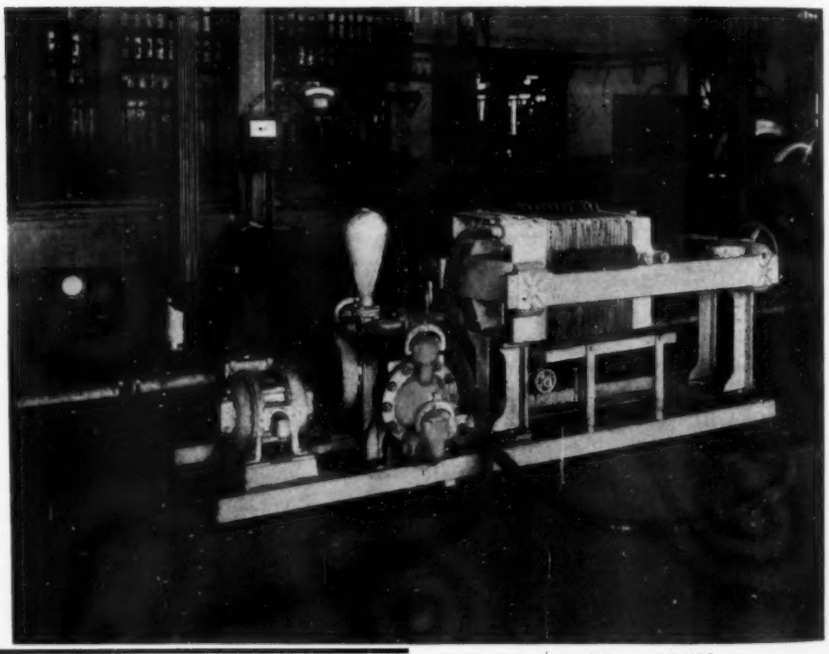


Figure VIII

Filtering solutions for plating household appliances using filter press.

(Courtesy T. Shriver & Co.)

TABLE III

SIZES AND CAPACITIES OF FILTER PRESSES

Size of Filter Plate Inches	*No. of Filter Chambers*	*Filtering Area—Sq. Ft. Metal or Rubber Covered Metal Plates and Frames*	*Wood or Solid Rubber Plates and Frames*	*Capacity—Gallons per Hour Metal or Rubber Covered Metal Plates and Frames*	*Wood or Solid Rubber Plates and Frames*
7	4	2	..	40-50	.....
7	8	4	..	80-100	.....
12	6	10	5	200-250	100-125
12	12	20	11	400-500	220-275
12	18	30	16	600-750	320-400
18	12	46	..	950-1150	.....
18	18	70	..	1400-1750	.....
24	12	84	58	1700-2100	1200-1450
24	18	126	87	2600-3150	1750-2150
24	24	168	115	3400-4200	2300-2850

(Courtesy of T. Shriver & Co., Harrison, N. J.)

pump with the piston actuating rubber diaphragm at both ends separating the liquid from the operating mechanism. The liquid ends, including ball valves and valve seats as well as manifolds and equalizing chamber, can be made of any metal or rubber coated. These pumps are easy to inspect and clean, and having no packings, do not leak, and because they are positive in pressure, give a constant capacity as the pressure increases. When a filter is first started with the clean filtering medium (cloth), it requires very little pressure but the pressure increases as

the quantity of solids on the filtering medium accumulates.

Centrifugal and rotary gear pumps are also used.

Filter Cloths

For most plating solutions, a clean cotton twill or a chain cloth is the most economical. A commonly used cloth has the following specifications: chain weave, weight, 15 ounces per sq. yd.; thread count, 56/40 (3 ply and 2 ply respectively). For acid solutions, cloths mentioned in Table II are satisfactory.

Filter Paper

Frequently the life of the filtering canvas is increased by the use of filter paper. Filter papers are usually not used with filter aids. The specifications for the filter paper to be used naturally will vary with the pressure and mode of application of pressure during filtration, and the quality of filtering desired. One type of filter paper being used for filtration of a bright nickel plating solution, is one which is about ⅛" thick with a consistency of very hard blotting paper. Another filter paper being used for a cyanide zinc solution is a lightweight kraft about 0.014" thick. The filter papers may be made of 100 per cent cotton or mixtures of cotton and wood pulp stock.

Conclusion

This paper has attempted to show the important features of the various types of filters on the market available for filtration of plating solutions. There are other types of filters being used (especially in Europe) which have not been considered because of their low filtration rate. One of these is the candle type of filter which uses earthenware candles as the filtering medium rather than canvas.

The author believes that the values accrued from filtration more than offset the costs of filtering or the apparatus for filtration. These benefits include less porous deposits, smoother, brighter finishes, easier buffing, and the use of higher current densities and agitation which could not be used when the solution contains solid matter.

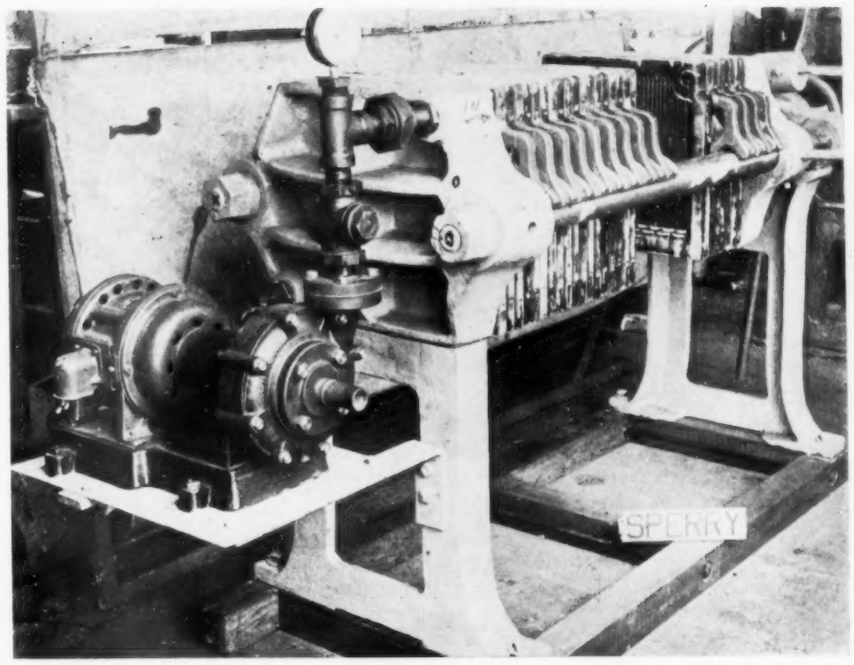


Figure X

Filter press equipped with rubber-covered cast iron plates and frames and connected to a solid rubber motor-driven pump.

(Courtesy D. R. Sperry & Co., Batavia, Ill.)

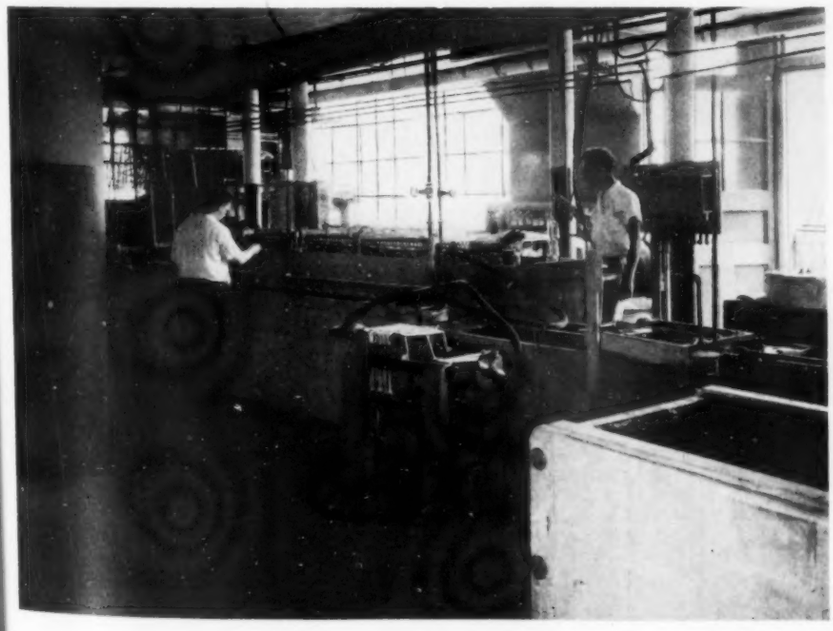


Figure IX

A portable filter plate unit for filtering solutions used in job plating.

(Courtesy T. Shriver & Co.)

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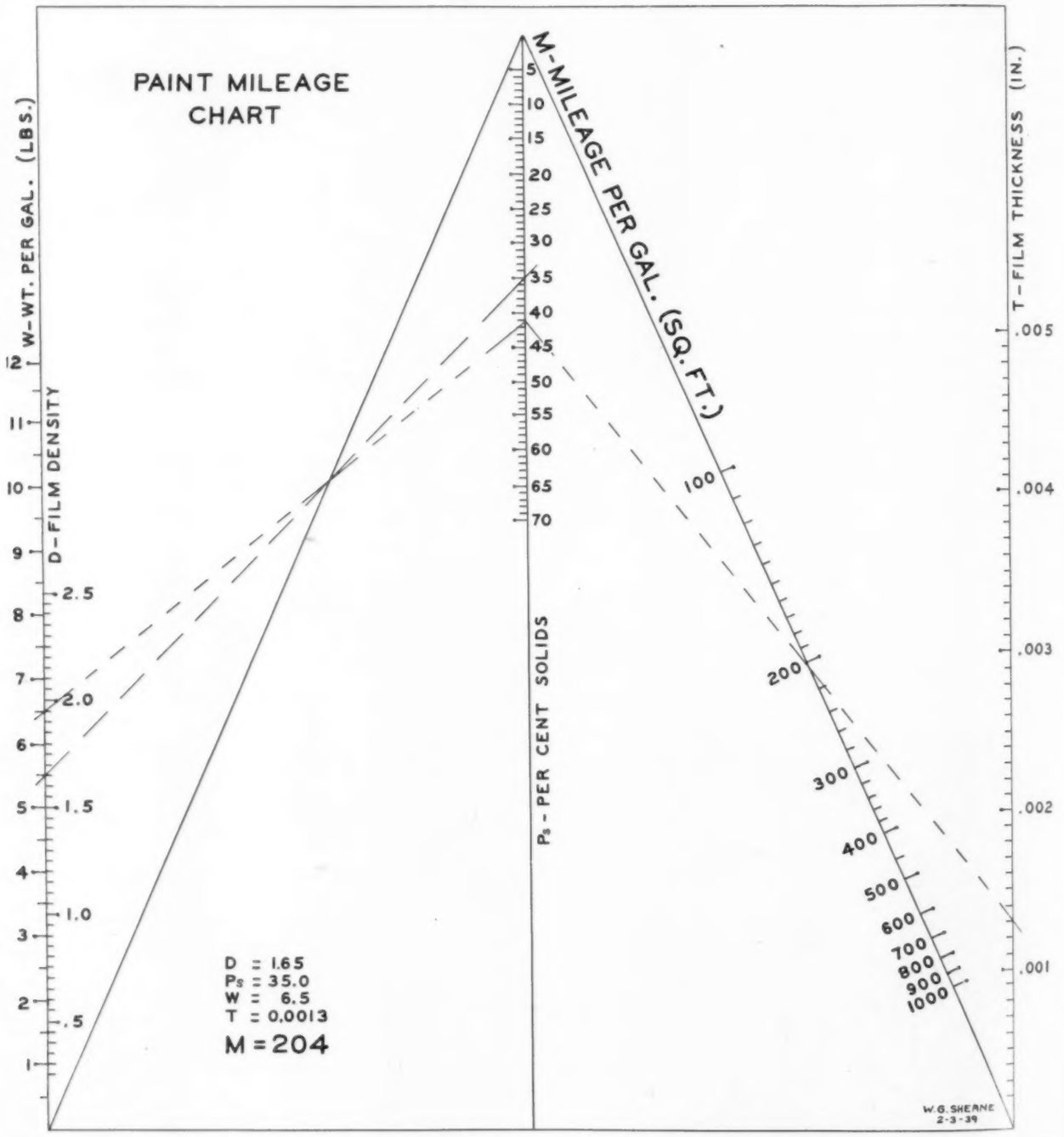
ACKNOWLEDGMENT

The assistance of *Philip Kriegel* of T. Shriver & Co. in gathering information on filter presses and *T. Lundberg* of The Industrial Filter & Pump Mfg. Co. for data on filters is gratefully acknowledged.

Chart for Calculating Paint Mileage

In connection with the calculation of paint coverages as discussed in the February issue of METAL INDUSTRY, W. G. Sheane, the author, has prepared the chart on this page. Paint coverage in square feet per gallon may be easily and quickly determined from the chart without the necessity for mathematical calculations. —Ed.



Using the data set forth in the lower left hand portion of the chart, for example, the mileage may be found as follows:

(1) Draw a straight line connecting the values of D (1.65) and Ps (35.0). This line will intersect the sloping line to the left of the vertical center line.

(2) From the value of W (6.5) extend a straight line through the intersection obtained in (1) until it intersects the vertical center line.

(3) Draw a straight line connecting the value of T (0.0013) and the intersection obtained in (2). This line will intersect the mileage scale at the mileage value of M (204 square feet per gallon) for the material under consideration.

Coloring of Cadmium

By William J. Erskine

Electrochemist
National Lock Company, Rockford, Ill.

The use of cadmium electrodeposits for colored deposits offers a beautiful, silvery white highlight with high rust resistance. Colored films on cadmium produced by oxidizing agents (not sulphides) have good corrosion resistance per se in contrast with sulphide films whose lives are dependent on the protection of a clear lacquer film. Various solutions for oxidizing cadmium are given.—Ed.

Introduction

Colored cadmium when relieved to show its pleasing silver-like color lends itself admirably to those engaged in producing ornamental finishes so necessary in making our daily lives and homes more pleasant and livable. The effects commonly produced with cadmium as a base plate include such finishes as Pewter, French Gray, Wrought Iron, Swedish Iron, Argentine and Stratford Silver and Sheffield Silver.

Black on Cadmium

The most common means of producing black deposits on cadmium are the lead acetate-sodium thiosulphate bath also used for producing certain antique finishes on brass and nickel, and the copper sulphate-potassium chlorate bath. The former bath with a composition somewhat as follows:

Lead acetate (sugar of lead)	⅛ oz.
Sodium thiosulphate (hypo)	12 oz.
Water	1 gallon

Temperature 140°—200°F.

Tank—earthenware or cement-lined steel produces a uniform although powdery black which is not in itself very adherent. Additions to this bath of sodium carbonate or nickel sulphate, which are both used and recommended for improving the adherence, were found not to be very beneficial.

If improvement occurred, it was certainly not marked enough to merit notice. The softness and looseness of the black deposit makes it rather difficult to handle when highlighting operations on a wheel follow. This dip is suitable for producing a pewter finish on cadmium on flatware or articles which are free from ornamentation and lowground. It may also be used in producing French gray. A wet brushing on a steel wheel with powdered pumice stone (2F) is generally the procedure followed although resort is sometimes made to hand rubbing with steel wool and pumice. A coating of clear lacquer is essential to preserve the finish and prevent smudging and handling scratches which would otherwise ruin the not too adherent film.

Copper Sulphate-Potassium Chlorate Bath

Copper sulphate	2 oz.
Potassium chlorate (chlorate of potash)	3 oz.
Water	1 gallon

Temperature 140°—200°F.
Tank—earthenware or cement-lined steel.

This solution produces deposits quite similar to those from the first-mentioned solution in that deposits are loose from both baths, powdery and non-adherent. The copper-sulphate-potassium chlorate bath gives deposits that differ in having a deeper black color and are free of the bluish-gray tinge common in "sugar of lead" dips. This dip can be used with moderate success in producing wrought iron and Swedish iron effects. The fact that the film is soft and easily scratched means that the work has to be carefully handled to prevent scratches which allow the white cadmium to show through. The deeper shades of black which can be made with this dip give the greater contrast with the base plate required by the wrought iron or Swedish iron type of finish.

Recent modifications of this bath through additions of sodium chloride (salt) have made possible the obtaining of highly satisfactory deposits with much improved adhesion. The exact value of sodium chloride when added to the mixture is not known. The difference in adhesion before and after adding is, however, readily apparent. Earthenware or cement-lined steel tanks prove satisfactory containers for the solution.

Copper sulphate	2 oz.
Potassium chlorate (chlorate of potash)	3 oz.
Sodium chloride (common salt)	3 oz.
Water	1 gallon

Temperature 140°—200°F.

If the cadmium deposits are uniform and bright, a certain amount of lustre is evident in the deposit as it comes from the bath. The solution can be used cold; however, best results are obtained if the work is immersed in a hot solution (140°—200°F.) for one or more brief periods of 2-5 seconds each. Work can be dried by the use of hot water, sawdust, or in a hot-air dryer.

Further small additions of acid (sulphuric or hydrochloric) enough to dissolve any basic salts produced, tend to leave an adherent gray coating under a loose black deposit. This gray is quite suitable for pewter and French gray finishes as it is considerably more adherent than the coatings obtained from the lead acetate-sodium thiosulphate bath.

Brown on Cadmium

A rich warm brown on cadmium which shows off the silvery whiteness of the metal when highlighted is easily produced by the potassium dichromate-nitric acid bath.*

Potassium dichromate	1 oz.
Nitric acid 36° Be′	½ oz.
Water	1 gallon

Temperature 140°—160°F.

The finishes known as Stratford silver, Sheffield silver and Argentine have the authentic antique silver appearance when

*The Monthly Review, A.E.S., February, 1938.

highlighted artistically. The use of cadmium plate instead of silver makes possible the use of this finish in many places especially where silver itself cannot be used due to high material cost. The bath when heated to a temperature of 140°—160°F. is fairly quick acting. Pale yellows are obtained almost instantly. It requires from 2-4 minutes for a reddish brown color similar to that of mahogany. Deeper shades can be produced on prolonged immersion up to 6-8 minutes. Earthenware crocks heated by placing them in a hot-water bath are satisfactory containers for the dip.

The sequence of operations recommended is:

1. Cadmium plate to a thickness of approximately 0.0002".
2. Dry off in dry hardwood sawdust or in a hot-air centrifugal dryer.
3. Oxidize in the potassium dichromate-nitric acid bath.
4. Rinse in clean water.
5. Dry in a hot-air centrifugal dryer or hardwood sawdust.
6. Relieve highlights with a fast cutting composition such as Tripoli ends.
7. Tumble in sawdust to remove any excess composition.
8. Lacquer with a clear metal lacquer.

For a dull finish, follow through operation No. 5 and 6. Relieve with a "dull" compound, such as Lea composition Grade "A" and lacquer with a good flat metal lacquer.

It was found that the oxidizing solution worked much more uniformly when the work was taken directly to the bath without any burnishing, buffing or scratch-brushing operations. Nichrome baskets proved to be the most suitable for handling the work during the oxidizing operation, and the centrifugal dryer proved most satisfactory for drying after oxidizing.

In operation of the bath, frequent though small additions of nitric acid must be made and occasional additions of dichromate. When the bath reacts slowly after continued use, it is necessary to discard and make up a fresh solution. The film produced from this bath is tough and durable if the nitric acid concentration is not too high. Good deposits are capable of withstanding sharp bends and deformations without injuring their adherence.

The cost of operating the bath is exceedingly small as the concentration is weak and potassium dichromate and nitric acid cost but 9c. per lb. and 6c. per lb. respectively. Operators of the bath generally retain a little of the old solution in the crock when making up a fresh bath. The old stock helps to stabilize the new bath.

Conclusion

The use of cadmium as base plate for colored deposits makes available a beautiful silvery white highlight which has exceedingly high rust resistance. For ornamental work, the relieved portions appear almost the same as silver. The cost, of course, greatly favors the cadmium.

Pewter, French Gray, Wrought Iron, and Swedish Iron finished from the black dips withstand mild exposure considerably better than Statuary Bronze finishes on copper plated steel or the Antique English or Old English finishes on brass plated steel. The copper or brass plated steel depends primarily on a good lacquer film for protection.

The film produced from the potassium dichromate-nitric acid bath has a marked resistance of its own even without any additional protection from the lacquer film. This has shown itself to be true on repeated outdoor exposure tests and is confirmed by accelerated tests in the salt spray and humidity cabinet.

New Rolling Mill for Brass Copper and Copper Base Alloys

By W. R. Clark

Works Manager,
Bridgeport Brass Co.

The Bridgeport Brass Co., Bridgeport, Conn. has recently completed its new rolling mill at its Housatonic Avenue plant at a cost of $4,500,000. The new mill has a total floor area of 220,000 sq. ft. with a production capacity of 6,000,000 lbs. per month. A description of the equipment is given.—Ed.

Introduction

Devoted exclusively to the production of brass, copper and copper-base alloys in sheets, rolls and strips, Bridgeport Brass Company's recently completed rolling mill is designed to utilize heavy cast bars in standard widths, with multiple slitting to provide any desired combination of widths.

The new mill, built as part of the largest expansion and modernization program undertaken by any company in the non-ferrous metals industry since 1929, embodies in its design the straight-line production principle of materials handling. The mill lay-out, developed by the company engineers, is planned so that the flow of production is uninterrupted and materials proceed in one direction up and down the four main bays of the building from the first breaking-down mills to the inspection and shipping of the finished material.

Mill equipment consists in general of a two-high, universal, reversing-type, hot breaking-down mill; a two-high cold breaking-down mill; a two-stand, four-high, tandem, intermediate mill; two four-high, single-stand, finishing mills and a battery of two-high finishing mills with annealing and cake-heating furnaces, pickling, overhauling, slitting, shearing and handling equipment in proportion to the rolling mill equipment, permitting integrated and harmon-

ion operation between all individual units. Ample space is also provided in the 220,000 square feet of space contained in the building for inspection and shipping.

Slab Delivery

The metal to be rolled is melted in induction-type furnaces and cast into slabs in vertical metal billet molds. Slabs and bars are delivered to the new rolling mill via an underground passageway from the casting shop located across the street from the rolling mill building. Copper cakes for hot rolling are delivered directly to the mill building by railroad cars running on a siding parallel to one side of the

An exterior view of Bridgeport Brass Company's new $4,500,000 rolling mill with the new mill office and laboratory building shown in right foreground.

building. Space is provided adjacent to both the hot and cold breaking-down mills for the storage of metal to be rolled and delivery from this storage to the heating furnace or to the mill table is accomplished by cranes.

Heating of Slabs for Hot Rolling

The heating furnace for the hot mill is a continuous-type, oil-fired, cake-heating furnace and is erected parallel to the mill approach table. Cakes are passed through the furnace on heat-resisting skids in three parallel lines. The furnace is equipped with three hydraulically-operated elevators and charging is effected by three ramtype pushers controlled from the mill pulpit.

Automatic temperature control regulates the in-put of fuel to the furnace and each zone is controlled separately to permit efficient operation over a wide range of production. Cakes are moved through the furnace by the action of a pusher and, as one cake is fed into the furnace, a heated cake is delivered onto the furnace delivery table, which is set at right angles to the mill approach table. Spring-cushioned furnace bumpers are provided to absorb the shock of the cakes as they leave the furnace and pass to the mill approach table which is located on a lower level.

Hot Breaking-Down Mill

Passing off the furnace delivery table, the cake approaches the two-high, reversing-type, hot breaking-down mill, which is driven by a 1000 hp., direct current, reversing motor with a Ward-Leonard control.

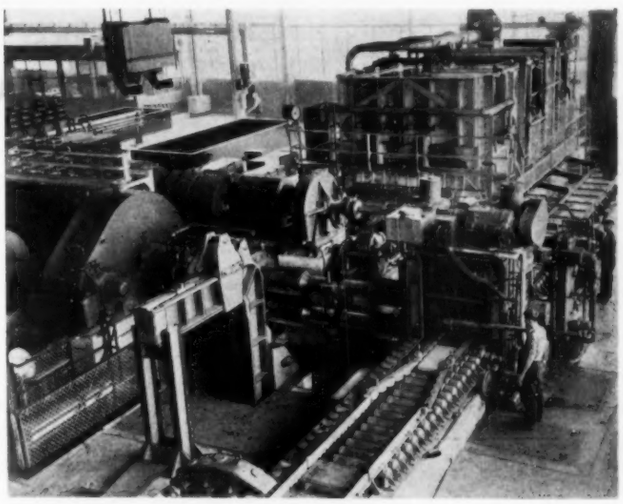
The horizontal roll screw-down and the edging rolls are controlled from the mill pulpit with Selsyn indicators to show the exact roll setting. The edging rolls are arranged so that they may be driven in either direction simultaneously with the rotation of the main rolls permitting edging in both the forward and reverse pass, or they may be operated only in the forward direction when the main rolls are running in this direction and remain idle when the main rolls are running in the reverse direction.

In addition to the mill proper, the hot mill unit consists of a furnace delivery table, front and back roller tables, a run-out and shear approach table, a chain cooling table and bar piler, a coiler and a vertical cropping shear.

The furnace delivery table and the front and back mill approach tables are of the same general design and construction and are run by individual motors. The rollers are forged steel, driven by entirely enclosed mitre gears, mounted on roller bearings. Both the front and back mill approach tables are equipped with automatic air-operated side guides.

The run-out table is of the same general construction as the front and back mill approach tables and is arranged for a cross-transfer from the run-out table to the cooling table and bar piler. The shear, which is a vertical, open-side type, is clutch-operated and is used for cropping the front and back ends of strip to be coiled.

The motor-driven coiler, located beyond the end of the shear delivery table, will handle all the material to be coiled



View of the two-high, reversing-type, hot breaking-down mill with the billet-heating furnace shown in the background.

and a gravity-spiral roller-conveyor is designed to carry the coils away from the coiler, and at the same time, up-end them. The adjustable chain-type transfer and cooling bed is provided for handling and piling the material to be worked in flat bars.

Cold Breaking-Down Mill

Also located at the front of the mill building, is a two-high, cold breaking-down mill that performs the first operation on metal to be worked cold. Slabs weighing upwards of 600 pounds are brought up from the underground pass-

age to a storage space located near the mill and are delivered in batches to the mill by cranes.

This unit consists primarily of the mill proper with a combination-type reduction gear and pinion stand, a lifting table equipped with a pneumatic pusher-sticker and an hydraulically-operated transfer pusher on the entry side, a delivery piling table and hydraulically-operated transfer pusher on the delivery side and a motor-driven transfer car.

After one or more piles of slabs have been placed by the crane on the stationary table on the entry side of the mill, they are moved by the transfer-pusher to the lifting table and are raised so that the top of the bar is in position for entering the mill. The top bar is then pushed off the pile and into the mill rolls by the pusher-sticker.

The motor-driven screw-down is controlled from the operator's stand, and the horizontal mill rolls are driven by a 2250 hp., alternating current motor, through a Cutler-Hammer magnetic clutch. This motor also drives the generator which delivers current to the reversing motor of the hot breaking-down mill.

Arrangement of the transfer-pusher and the transfer car to convey the slabs from the delivery side to the entry side keeps the mill in more or less continuous operation and, after a series of repeated passes, the slabs are delivered to a walking-beam-type furnace for annealing.

Annealing of Cold-Rolled Slabs

The continuous walking-beam-type slab annealing furnace is equipped with an automatically-operated elevator-loading and hoist-table and an automatically-operated stripper and feeding mechanism. This mechanism is pre-set for exact

A battery of four running-down annealing furnaces. From here metal goes through continuous pickling machines and then to ready-to-finish or finishing mills. (Continental Industrial Engineers.)

time movement and the slabs are passed directly through the furnace into a quench-tank on the opposite side.

The furnace is oil-fired by a series of automatically controlled burners, installed above the hearth on the entry side and below the hearth on the delivery side, and the slabs regardless of their length, width or thickness, are heated to a uniform temperature throughout.

A temperature control and recording instrument board shows the exact temperature of each zone at all times and directly compares this temperature with the temperature-setting indicator. A multiple recording instrument records the temperature of the entire furnace on a time-record graph.

Milling of Annealed Slabs

After cooling from this anneal, the slabs are transferred by crane to slab milling units where they are overhauled and prepared for further reduction on a four-high tandem mill. The milling units are equipped with flattener rolls and a roller table and flopover is provided between the two machines permitting continuous operation. The milling operation is always performed on the lower side of the slab so that the chips will fall away from the cutter and not be rolled into the face of the metal. Scrap from the overhauled slab is conveyed by air to either of two overhead storage tanks from which it is drawn and fed by a vibrating-conveyor and gravity to a hydraulic baling press placed vertically. This press makes a bale about 14 inches by 7 inches by 7 inches compressed from the loose chips with a pressure of about 3000 pounds per square inch.

Cold Rolling with a 4-High, Run-Down, Tandem Mill

After overhauling, the flat bars are inspected for perfect surface and are then delivered by crane to the four-high, run-down tandem mill.

Brass or copper, coming from the two-high, hot breaking-down mill, in flat slabs, is also delivered by crane to the slab miller and then to the four-high, tandem mill for further reduction by cold rolling.

The two-stand, four-high, tandem running-down mill will handle either coils or flat slabs and conveyor and handling equipment is provided for efficient transfer of material. Each stand is driven by an 800 hp., 0/575/1020 r.p.m., DC, adjustable-speed motor, and a motor-driven continuous oil-circulating system is provided for lubricating the combination drives.

Screw-downs of the two-motor type are equipped with magnetic clutches to permit independent adjustment of the housing screws when required. Selsyn-type indicators are provided at the operator's stand to show the housing screw setting.

In addition to the four-high roll stands, the unit consists of a lifting table equipped with a pneumatic pusher-sticker on the entry side of the first stand; a roller-top loading table at the outer end of the lifting table; a coil sticker located between the loading table and the first roll stand; a three-roll coiler, equipped with a tailing device which may or may not be used, attached to the delivery side of the second roll stand; a two-way coil conveyor; a coil opener for providing a straight end on coils when desired; and a return-conveyor to the coil-sticker loading device.

The lifting table and the pusher-sticker, similar to the one on the cold breaking-down mill, is used for the first pass of flat metal. After passing through the mill, the metal is coiled on the three-roll coiler which is equipped with an air-operated ejector which delivers the coil to the coil conveyor. At the rear end of the conveyor, which is of sufficient length to hold approximately 25 coils, the coils are transferred to a return-conveyor and returned to the coil-sticker loading device for another pass.

Annealing of Coils

Run-down annealing for coils from the four-high tandem mill is accomplished in a bank of four gas-fired, clean annealing furnaces with a temperature range of from 900 degrees to 1300 degrees Fahrenheit. Fuel consumption and performance characteristics are variable for annealing either copper or brass.

Coils from the tandem mill are loaded by crane onto heat-resisting alloy trays and placed on a motor-driven transfer car which runs on tracks parallel to the entrance end of the four furnaces. Charging if effected directly from this car and, as one tray of coils is pulled into the furnace by a motor-driven car tray-puller, operated at the delivery end of the furnaces, an annealed set of coils is removed from the sealed-in quenching chamber located at the discharge end of the furnaces.

The temperature of these furnaces is automatically zone controlled and, by preventing the entrance of air into the furnace and quenching the metal in furnace temperature, excellent surface condition is retained. The furnaces are so designed that, when continuously operated, the temperature in any coil in the final soaking zone immediately prior to discharge will not vary more than plus or minus 15 degrees Fahrenheit.

Pickling

From the run-down annealing furnaces the coils are passed through continuous pickling machines and prepared for further running-down or for the finishing mills. The pickling operation, at this point, is accomplished by a continuous push-through type machine for treating heavier gauge metal and by a double-trough pull-through type unit, operated at variable speeds, for treating lighter gauge metal of various widths. The sequence in pickling is (1) 10% sulphuric acid at 130°F, (2) squeeze rollers and brush, (3) 10% sulphuric acid at 130°F, (4) water spray with roller and brush, (5) hot water spray with roller and brush, and (6) hot air drying.

Finish Rolling

Coils are brought from the continuous pickling machines or directly from the annealing furnace to the four-high, ready-to-finish mills, with main rolls independently driven by 400 hp., direct current motors.

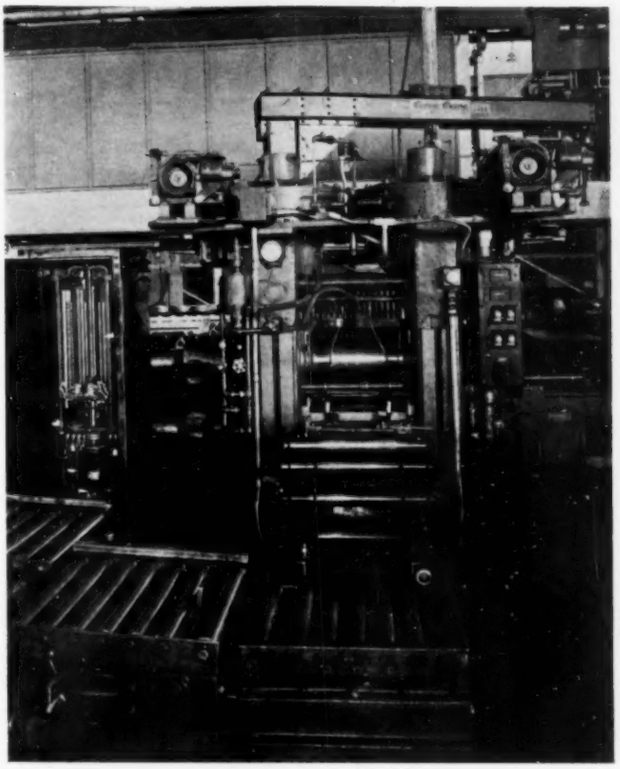
Auxiliary equipment for these mills consists of an electrically-controlled tension reel with an air-operated block, blocker, hydraulic stripper and stripper-carriage; a friction-clutch reel, with an air-operated block, blocker, hydraulic stripper and stripper-carriage; two un-coilers with collapsing mandrels with hydraulic stripper and stripper-carriages; one re-winding reel with a hand-collapsing block and stripper-carriage, and a specially designed conveyor system which permits a continuous cycle of operation.

Coils coming from the ready-to-finish mills or directly from the continuous pickling machines are rolled to finished gauges by finishing mills located in bay No. 2.

All finishing mills are of more or less the same general design and are equipped with rolls of varying lengths. Special handling equipment, such as roller conveyors and jib-cranes, is used with the mills to provide continuous operation and permit efficient handling of materials.

Also located in this bay, which is devoted entirely to rolling to finished gauges, are two mills for finishing small orders and a mill for the special rolling required for engraver's copper.

Coils are delivered from the finishing mills to bay No. 3 where they are put through the finish-annealing furnaces and the finish-pickling machines. The finish-annealing

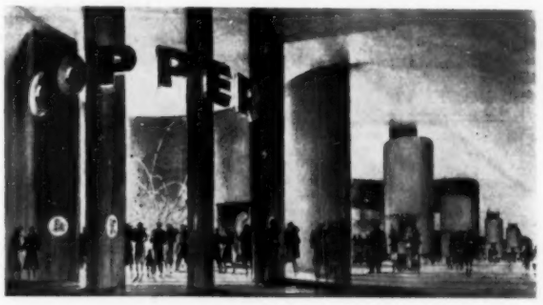


The entry side of one of the two-high finishing mills. (Built by Farrel-Birmingham Company.)

equipment in this section of the mill includes twin-type, recirculating, oil-fired annealing furnaces, and continuous, pull-through type, gas-fired annealing furnaces for open and gas atmosphere finish-annealing. Continuous pull-through and push-through type pickling machines are used for finish pickling before the metal is delivered to the inspection benches.

After inspection, the coils are delivered to the finishing department where they are prepared for shipment by the straighteners, slitters, shears, stretchers and circling machines. The coils then proceed directly to the shipping department where they are loaded into freight cars or trucks.

Copper and Brass Industry Exhibit
at
New York World's Fair



PLATING AND FINISHING
FABRICATION — ASSEMBLING
METALLURGICAL — ROLLING
CASTING AND JOINING

SHOP PROBLEMS

Technical Advisors For March Issue

G. BYRON HOGABOOM

Consultant in Electroplating and Metal Finishing, Newark, N. J.

DR. C. B. F. YOUNG

Consultant and Technical Director, A. Robinson & Son, New York, N. Y.

W. J. REARDON

President, National Alloys Co., Detroit, Mich.

When sending solutions for analysis please give following information: name and address; class of work being plated; kind of solution and volume; length, width and depth of tank; temperature of solution; current density, cleaning sequence and any other pertinent facts.

Full information is necessary in order to render proper service.

Gold Plating Rack Metal

Q. Can you tell us whether Inconel metal can be used to string up gold filled temples for gold plating? We use a gold cyanide solution for plating. In other words, will the use of the Inconel metal necessitate more current, less current or the same amount as we are now using, and will the plating be good?

A. It is quite possible to use Inconel metal for cathode racks. However, several factors must be kept in mind when doing this. Inconel is an alloy consisting of 79.5% nickel, 13% chromium and 6.5% iron. From the above formula, one would expect the alloy to offer a high resistance to the passage of an electric current. The above expectation is true, as this material has a resistance of 650 ohms per mil foot, while copper has a resistance of only 15 ohms per mil foot. From these figures it can be seen that copper is a much better conductor than is Inconel, the ratio being about 43:1.

In designing the racks of Inconel, the above must be taken into consideration, otherwise for a given voltage the current flowing through will be much less for this alloy than for pure copper. This, of course, can be overcome by increasing the cross-sectional area of the cathode racks. Inconel being an alloy and a conductor of electricity, naturally will receive a deposit of gold when it is made the cathode in such a solution. Therefore, all parts of the rack which are exposed to the solution with the exception of the contact points, should be insulated by the usual methods.

Inconel can be used for cathode racks but it is not as good a conductor as is copper. In order to produce the same amount of current a higher voltage drop may be necessary depending upon the cross-sectional area of the cathode bars.—C. B. F. Y.

Copper Plating for Selective Carburizing

Q. Will you please give us information on copper plating for carbonizing (carburizing)? We are copper plating for this purpose in a barrel and are having some difficulty with the carbon penetrating the copper deposit.

A. In copper plating for selective carburizing, the thickness of copper required depends upon the depth of case desired. To carburize to a depth of .010", it is necessary to copper plate to a thickness of .0005". It is likely that your trouble is due to insufficient copper plate.

To test the thickness of copper for your purpose, remove a piece of work from the barrel, wipe dry, and clean off a spot with a rag wet with alcohol. Apply a drop of test solution using a glass rod or dropper. Allow the drop to remain 9 seconds, then wipe it off using a clean rag or blotting paper. Apply another drop for 9 seconds, and repeat until the test drop shows a brown coloration showing that the copper has been removed and that the iron is being attacked.

Each 9 second-period represents .0001" of copper.

Test solution: 1 part C.P. nitric acid, 1 part distilled water by volume.

For obtaining heavy deposits in a barrel, you will require at least 6 volts at the barrel and even higher voltages may be used if the solution is of proper composition so that excessive anode polarization does not occur.

G. B. H., Jr.

Foundry Sand

Q. Please let me know if there is any foundry that uses French sand for very fine work. We want to make a permanent mold out of cast iron for aluminum.

A. French sand is used with No. 0 Albany sand by some foundries for

making sharp clean iron or brass for die and slush molds true to pattern. We suggest a sand mixture of:

50% ground French sand
30% Windsor Lock sand
20% No. 0 Albany sand
1% flour

Tempered with molasses water.

We also suggest that you aerate your sand if you have such equipment. If not, mix well and riddle several times to increase permeability and porosity. The permeability of a sand may be defined as the property which it possesses of allowing liquid or gas to filter through. We also suggest skim drying of such molds for die work.

W. J. R.

Thickness of Tin on Brass

Q. We are anxious to find a method for the determination of thickness of plating of an electrically deposited coating of tin on brass. We are mainly interested in some sort of stripping test to determine the minimum thickness of plating on any certain piece.

A. The determination of local thickness of tin on brass has not received intensive study nor are there any articles available to the writer's knowledge dealing specifically with this problem.

It would seem that the most pertinent data exist in the paper by S. G. Clarke on "The Use of Inhibitors in Removal of Coatings and Rust" (Trans. Electrochem. Soc. Vol. 59, 1936, pp. 131-144) from which it would appear that hydrochloric acid of sp. gr. 1.16 should be satisfactory for this purpose.

If thicknesses greater than a few ten-thousandths of an inch are to be tested, the addition to the acid of 2% antimony trioxide decreases the attack on the brass by deposition of a protective, thin, non-adherent deposit of antimony on the latter which is readily wiped off. The following table, quoted from the above, illustrates the relative attack on rolled pure tin and on rolled 70:30 brass:

Loss in Weight in Grams/dm². (68°F±4°)

	HCl sp.gr. 1.16		Same acid with 2% Sb_2O_3	
Time	Brass	Tin	Brass	Tin
1 min.	.0006		.0011	
10 min.	.0012	.264*	.0012	5.02*
3½ hrs.	.0070		.010	

*Author's note: .264 g/dm² is equivalent to .000142″ thickness.
5.02 g/dm² is equivalent to .0027″ thickness.

For conveniently determining minimum thickness, some experimentation and standardization is necessary. It is suggested that the entire article be stripped in the above, under fixed conditions, and the time and place of first appearance of the basis metal (indicated by cessation of gassing) noted. By reference to a previously determined curve correlating time with thickness, the minimum thickness can be ascertained. An alternative method might be to stop-off the article except over a small area suspected of having the thinnest deposit, strip as mentioned above in an unused solution containing no antimony, and determine the tin analytically. From the figures for the weight of tin stripped and the exposed area, the thickness can be computed or read from a prepared chart.

It has been claimed that a spot test may also be used for determining tin thickness locally, but no data as to the accuracy of this method are available. The solution recommended contains 1 part by volume of concentrated nitric acid and 3 parts of water. A drop of this is placed on the tin surface for five seconds, then rinsed off and the spot examined. This is repeated until the tin is removed at that spot. The number of drops used is proportional to the thickness, it being necessary to first determine the exact correlation figures by trial on known thicknesses of tin (for example, microscopically measured). Naturally, hydrochloric acid may be used, with or without antimony, instead of the above dilute nitric acid.—Silver Technologist.

Low Fusing Alloys

Q. We would like to secure the composition of some alloys fusing below 212°F (100°C) so that they can be melted in boiling water. Why does a mixture of metals sometimes melt at a temperature lower than the lowest melting point of any of the constituent metals?

A. The conditions for one metal to form alloys with other metals which melt at temperatures lower than the melting points of the constituent metals are that the liquid metals be soluble in each other and the solid metals precipitating from the molten mixture should have little or no solid solubility. The melting points of metal mixtures which are completely soluble in the liquid and solid states are in direct proportion to the amounts present. Thus copper will lower the melting point of nickel in an amount proportional to the relative quantities of copper and nickel present. It is also evident that lead, for example, would have little effect on the melting point of zinc due to the very limited mutual solubility of these metals in both the liquid and solid states.

The lowest melting alloys are called eutectic alloys and we may have binary, ternary, quaternary and even higher eutectic alloys. The higher the number of constituent metals, the lower the melting points. There is only one eutectic composition for metals which do not form compounds.

I know of no binary alloys of relatively strong metals which melt below 212°F although it is possible to make binary alloys with such a low melting point out of weak or liquid metals such as mercury, or gallium.

Some low fusing ternary and quaternary alloys are:

Percentage Compositions				
Bismuth	Lead	Tin	Cadmium	Melting Point
50	25	12.5	12.5	65.5°C
50	28.6	14.3	7.1	70°C
43.75	25	25	6.25	80°C
50	42.86	...	7.14	82°C
50	31.25	18.75	...	90°C
50	...	30	20	95°C
20	50	30	...	100°C

The above-listed compositions are for the mixed alloys and hence some experimenting will have to be done to allow for losses in melting so as to arrive at the correct composition.

—W. R. M.

METALLURGICAL DIGEST

SELECTED ABSTRACTS ON CASTING—ROLLING—PHYSICAL METALLURGY

Non-Ferrous Foundry Practice: The Bronzes. Part IV and a Portion of Part V. J. Laing and R. G. Rolfe, Metal Ind. (London) April 1,1938, Page 355 & April 15, Page 405.

Copper alloys containing more than 16% tin go through various transformations during cooling. For example, in bell metal (80% copper, 20% tin) crystals of primary alpha separate out first, their tin content increasing as the temperature falls. At 799°C. the beta phase, of higher tin content, begins to form but changes over to beta prime at 590°C. At 518°C. the latter breaks down to form an alpha plus delta eutectoid which, mixed with primary alpha, is the normal structure at ordinary temperatures.

The eutectoid, which consists substantially of the intermetallic compound $CuSn_4$, appears in the form of light colored particles scattered through the alpha matrix. The eutectoid is hard and brittle with a Brinell hardness of 220 as compared with 80 for the alloy as a whole. It is this dispersion of hard particles in a soft matrix which makes the cast bronze alloys suitable for bearings.

Alloys containing less than 16% tin, slowly cooled, consist entirely of the soft and ductile alpha solid solution which increases in strength and ductility as the tin content increases. However, in actual foundry practice more rapid cooling results in the formation of the eutectoid in alloys containing more than 7% tin. The addition of zinc to alloys lower than 7% in tin will produce the eutectoid if the tin content plus half the zinc exceeds 7%.

In general, a given percentage of zinc in the alloy has about half the affect on its structure and properties as the same amount of tin. By the use of zinc with tin, alloys suitable for many conditions of service can be produced more cheaply than if tin alone is used.

In a typical cast gun metal (88% copper, 10% tin, 2% zinc) scattered particles of the eutectoid are found in an alpha matrix. A high casting temperature, promoting slow cooling, decreases the amount of eutectoid while a low casting temperature increases it. The delta constituent (eutectoid) renders the alloy unworkable at ordinary temperatures but by heating above 590°C. the beta constituent is formed, the alloy becomes malleable and can be forged or rolled. Above 799°C. the beta begins to melt and the metal can be broken by hammering.

The "as cast" structure makes a good bearing metal but heating dissolves the eutectoid and destroys the bearing properties.

Among the impurities likely to be found in gun metal, aluminum is one of the most objectionable and should be entirely absent, since it causes surface defects and an unsound structure.

Antimony should be limited to 0.30%. In larger quantities it produces an intercrystalline eutectoid with impairment of physical properties.

Like antimony, arsenic causes a progressive deterioration in the strength and ductility of the sand cast alloy and should be limited to 0.30%. However, remelting reduces the effect of arsenic.

Bismuth also causes a brittle intercrystalline film and should be limited to 0.10%. Up to this amount it increases fluidity and improves machinability.

Up to 0.30% iron may be permitted; above that point it begins to cause brittleness. Gun metal containing 0.5% or so of iron pours sluggishly into scabby castings with hard spots.

Lead is usually limited to 0.5% because it has some tendency to cause segregation. It does not alloy with the other constituents but is usually found associated with the eutectoid. Actually the author has found that up to 1.5% lead slightly increases the strength of the gun metal, greatly increases its ductility, impact resistance and machinability. In steam metal lead up to 2% definitely increases the steam resistance of the alloy at temperatures up to 260°C. As much as 10% is commonly used in the bearing bronzes, which less frequently are made with 25 to 50% lead plus 1 to 2% nickel to restrain segregation.

Although commonly limited to 0.2% in gun metal, nickel is not injurious and may even be beneficial up to 1.0%; it is widely supposed to refine the grain and increase strength and hardness. If desired, nickel should be added as cupro nickel.

Nickel may be substituted for half the tin in 88-10-2 without injurious results. The nickel bronzes may also be heat treated to further improve their properties. A bronze containing 8% tin and 7½% nickel has been heat treated to a tensile strength of 40 tons per sq. in., with 15% elongation. These bronzes are markedly superior to 88-10-2 at elevated temperatures.—H. M. St. John.

An Oxygen-Free Copper Development. Anon. Metallurgia, April 1938, Page 207.

It is well known that ordinary commercial copper contains oxygen in the form of cuprous oxide. This oxide dissolves in molten copper, somewhat lowering its freezing point, but is insoluble in solid copper. As the metal freezes, pure copper separates out first until the oxygen-rich liquid reaches the eutectic composition. The eutectic then freezes out along the grain boundaries forming a network which separates the pure copper crystals.

Since an excess of cuprous oxide impairs the electrical conductivity and mechanical properties of copper, the process known as "poling" is commonly employed to reduce the oxygen to a desirable minimum. This process is somewhat uncertain in its results and castings made from poled copper contain an irregular distribution of the oxide. If the metal is "overpoled" it becomes brittle. In properly poled copper, called "tough-pitch," the oxygen content is approximately 0.04%, except at the surface where it may be as high as 0.4%.

A special process has been developed by an English concern whereby copper substantially free from oxygen is produced. Special casting methods are used to produce this metal which is known as Bicop. It is cast vertically instead of horizontally as in usual practice. It is claimed that Bicop makes castings of exceptional uniformity and purity, excelling tough-pitch copper in toughness, ductility, high density and resistance to fatigue. This has been confirmed by tests which, however, show little difference in tensile strength and electrical conductivity.

The Effect of Small Additions of Tellurium on the Mechanical Properties of Pure Tin. By D. Hanson and W. T. Pell-Walpole. Institute of Metals Paper No. 814, 1938.

The preparation of tin-rich tellurium-tin alloys is described and some typical microstructures are given. Tensile, Brinell hardness and creep tests were carried out on machined chill-cast specimens and on rolled strips of alloys containing up to 0.1% tellurium. The effects of cold-rolling and of various heat-treatments were studied.

Additions of up to 0.1% tellurium slightly improve the Brinell hardness and tensile strength of tin but heat-treatment of the alloys does not produce permanently improved properties. These tellurium-tin alloys have a remarkable capacity for work-hardening in the chill-cast state, but this is diminished if the ingots are annealed before deformation. Grain-size may be a factor affecting work-hardening capacity. Tellurium considerably improves the creep strength of pure tin, both in the cast and in the rolled conditions. The work hardening properties of these alloys may form a valuable guide to their relative creep strength.

Grain-size measurements were made after various mechanical and thermal treatments, and it was found that the grain-size has a marked effect on the creep strength of these alloys; this confirms previous work by Hanson and Sandford.

ELECTROPLATING DIGEST

SELECTED ABSTRACTS ON PLATING—FINISHING—RUST PROOFING—LACQUERING

A RESUME OF PLATINUM PLATING

By Joseph B. Kushner

Monocraft Products, New York, N. Y.

Platinum, the silvery grey mother metal of the precious platinum group of elements has been electrodeposited since the birth of the art of plating over 100 years ago. Its use in this respect was first mentioned in the patent literature by Elkington[1] who described its application as an immersion dip (an aqueous solution of platinic chloride).

As a metal and as an electrodeposited coating, platinum has many interesting properties. It is a noble metal; it is one of the heaviest elements (density, 21.3); it is highly refractory (melting point, 1775°C.); is insoluble in the common chemical reagents and will not tarnish or corrode in ordinary atmospheres. It is ductile, and in the plated form is only a little softer than electrodeposited chromium.

While these unique chemical and physical features seemingly indicate its great possibilities in the field of electroplating, there are several disadvantages to the use of platinum which have held it back and have prevented it from assuming popularity as a plating metal.

The jewelry houses have always sought a flash electroplate to brighten and whiten their white golds. To this effect, before the advent of rhodium in the early 1930's, they used tin and even chromium as flash platings over white gold. At the time, platinum could not be used as it did not produce bright enough deposits for flash work in the plating solutions then available. When the platinum bath was perfected to really give bright, clean, flash plates, its relative, rhodium, made its appearance as a plating metal. Rhodium gives a brighter and whiter deposit as can be understood from the reflectivity measurements of both metals to white light (rhodium 78, platinum 65). However, since the price of rhodium is high, the trend is towards other metals, less expensive, and perhaps now platinum may be used more in the jewelry line as many beautiful and decorative finishes can be obtained with two-toned effects of platinum and gold.

Platinum immersion baths were at one time extensively used to produce French grey finishes on silver plate but the relatively high cost of the metal ($35.00 per Troy ounce) has precluded such usage.

Platinum plating is eminently suited for electrical contacts which must withstand heat and abrasion. Abrasive tests tend to indicate that a layer of platinum can withstand as much abrasion as a layer of silver 40 times thicker. Several corrosion tests were carried out on platinum plating among which the most prominent were those of Smith[2]. These showed deposits of platinum to possess excellent protective properties against corrosion when properly applied.

When deposited from modern types of baths, platinum is excellent for covering chemical apparatus such as evaporating dishes, etc., which must be subjected to the action of corrosive liquids and gases. However, such deposits cannot withstand temperatures above 400°C[3].

It must be remembered that platinum when deposited to prevent corrosion only does this if it covers the basis metal completely. If it does not do so, and if the deposit is thin and porous, it will accelerate rather than retard corrosion because of its low position in the electromotive series of metals. Therefore when it is applied for protection purposes a heavy deposit should be plated out because thin layers are apt to have hair-line cracks and pin holes.

All platinum baths must be used with platinum anodes as other types of anodes will dissolve and contaminate the bath, although there is a patent on the use of electrolytic nickel as an anode material in the phosphate bath granted to Bart[4]. Platinum anodes are, in the modern types of baths, completely insoluble, which in a certain sense may be considered a disadvantage as additions of platinum compounds, especially to the phosphate baths may build up inert salts with a deleterious effect. However, certain of the baths overcome this difficulty, as will be described further on.

Platinum Plating Baths

Early electrolytes for platinum plating consisted of simple solutions of the chlorides such as the solution used by Luckow[5] which was made up of a dilute solution of platinic chloride mixed with common table salt. Unfortunately these comparatively simple types of baths produced, at best, dull deposits. Present day baths of the complex type produce bright adherent deposits and are much more satisfactory in every respect.

In the gradual change from the simple ineffectual types of platinum plating solutions to the present day efficient and highly complex ones, many types of electrolytes have been evolved, which can best be described in a chronological order.

(1) THE CHLORIDE BATHS (1840-1885)

The prototype of this form of plating bath consists of solutions of platinic chloride ($PtCl_4 \cdot 5H_2O$) or chloroplatinic acid ($H_2PtCl_6 \cdot 6H_2O$) or ammonium chloroplatinate ($(NH_4)_2PtCl_6 \cdot 6H_2O$) acidulated with hydrochloric or sulphuric acids. With high concentrations of free HCl, platinum anodes are soluble but unfortunately spongy deposits result and base metals are attached. Since this type of bath is no longer in use as it produces dull or non-adherent deposits and is quite unstable, no actual formulae will be given.

(2) THE CHLORIDES PLUS ORGANIC ACIDS OR THEIR SALTS (1850-1900)

These baths possess the advantage of being somewhat more stable than those of type (1) as the organic acid or its salt acts as a buffering agent, preventing the decomposition of the platinum compound in alkaline regions near the cathode. Furthermore, the formation of complex platinum bearing ions is conducive to brighter, finer grained deposits.

A typical formula is that of Wahl[6]:

Platinic hydrate	8.2 grams/liter
Oxalic acid	32.8 grams/liter

Distilled water is recommended.

Temperature 150°F. Current density and voltage are not given. Wahl mentions that copper and brass may be plated directly but other base metals must be coppered first.

Another formula is that of McCaughey and Patten[7]:

Potassium chloroplatinate	20 grams
Citric acid	100 grams
Water	1000 ccs.

Use hot.

(3) THE PHOSPHATE BATHS (Rosaleur Bath) (1855-present day)

This type of bath consisting of the platinum chlorides mixed with alkali and ammonium phosphates to form highly complex platino phosphates was first suggested by Rosaleur and Lannoux[8] and is still in use in modified form today as it gives bright adherent deposits of platinum. Here are two solutions based on the original formula of Rosaleur, as given by Blum and Hogaboom[9]:

Platinum (as chloride)	5 grams/liter
Di-ammonium phosphate	45 grams/liter
Di-sodium phosphate	240 grams/liter

or

Platinum (as chloride)	4 grams/liter
Di-ammonium phosphate	45 grams/liter
Boric acid	15 grams/liter

These solutions are to be used about 70°C with low current densities of 1 ampere per sq. ft. or less.

(4) THE NITRITE BATHS (1927-present day)

The complex nitrites of platinum were first proposed as electrolytes for plating by Keitel and Zscheigner[10] in the latter part of the 1920's. These baths produce bright, highly satisfactory deposits.

Concluded with bibliography in April issue.

Post Scripts

Henry Painter of the N. Y. Branch of the A.E.S. called attention to the following menu for electroplaters of the St. Louis Branch, published in the January 1915 Monthly Review:

Menu

Consomme a la Potash
Oxidized Celery
Pickled Radishes
Electrocleaned Roast Turkey
Reversed Current Cranberry Sauce
Copper Plated Potatoes
Wire Beans
Barrel Plated Peas
Nickel Plated Crackers
Polished Cheese
Cyanide of Coffee

• •

Dr. William Blum's interest in electrodeposition started July 24, 1913, at which time he was called by the Bureau of Printing and Engraving to investigate an electrotyping solution.

• •

New adjectives will have to be found to describe the annual meeting of the *Chicago Branch of the A.E.S.* held on January 28 as "super-colossal" was already used to describe the Detroit affair. (Perhaps California grapefruit terminology would be apropos). Our scouts report that 847 people attended the banquet and dance, and over 300 listened to the technical papers. We folks in the East are still wondering how Chicago did it.

• •

Did *Bill Cole* and *C. L. Southwick* (Detroit), Wyandotte stalwarts recently help the Detroit curlers beat the Canadiens?

• •

In a recent discussion with *Theodore Eichstaedt* (Detroit) and *Floyd Oplinger* (Niagara Falls) on zinc plating of grey iron, two methods were suggested to start deposition. Ted Eichstaedt suggested adding 2 oz. of tin chloride to each batch of work in a 60-70 gallon barrel and Oplinger suggested immersion tinning in a tin chloride-tartaric acid solution.

• •

If you noticed any of the following men sporting an off-season tan, its genuine and not a sunlamp synthetic as they recently have been to Florida. The lucky ones were *George Spencer*, Crown Rheostat & Supply Co., *Charles Gross*, Henry V. Walker Lacquer Co., *Ben Popper*, Egyptian Lacquer Co., and *Oliver Sizelove* of Frederick Gumm Chemical Co. Ben is a regular devotee of southern travel but Oliver Sizelove said it was the first real vacation he has ever taken.

• •

Titanium nitride is said to be hard enough to scratch rubies and will cut diamonds slowly.

I am pleased to show below a picture of *Dr. Alexander Glazunov* and *E. A. Ollard* which I snapped in Windsor Castle, England, late one cold, foggy afternoon in February. Mr. Ollard was chairman of the First International Conference on Electrodeposition, held in London in February, 1937. His brother was a Canon in the English church and consequently we were able to see many of the crypts, secret rooms, etc., in Windsor Castle which are never seen by tourists. Mr. Ollard and his committee were punctilious hosts to the foreign visitors including the writer, and set high standards of hospitality which we must strive to live up to in entertaining foreign guests at the Second International Conference on Electrodeposition to be held in June at Asbury Park, N. J.

Prof. Alexander Glazunov (Czecho-Slovakia) and E. A. Ollard (England) snapped inside the walls of Windsor Castle.

Dr. Glazunov is Professor and Rector of the Technical University in Pribram, Czecho-Slovakia. He has published numerous papers on electrodeposition and particularly on crystal formation. Prof. Glazunov is a most interesting person, is of Russian descent and is an accomplished linguist. He gave the never-to-be-forgotten toast to the ladies at the banquet of the F.I.C. on Electrodeposition. METAL INDUSTRY goes to Czecho-Slovakia and if Prof. Glazunov reads this, I will be pleased to hear from him and will forward an original print.

• •

Abner Brenner of the Bureau of Standards, certainly has fortitude. He recently crawled inside a large 16″ gun to measure the thickness of plate *in situ* using his magni-gauge.

Frank Mesle of Oneida Ltd., Oneida, N. Y., was on a nation-wide radio hook-up Saturday evening, February 18 in a program devoted to electroplating. Frank, we are proud of you.

• •

Fred Norgren, New England representative of Frederic B. Stevens, Inc., Detroit, Mich., has a method for plating nickel over nickel which he used over 35 years ago with nary a failure. If you're interested, write him, as, although Fred is now engaged in sales work, he likes to spin yarns about his years as a production platerr.

AT THE N. Y. NEWARK CONVENTION

People seated, named clock-wise: Walter Bayer, Mrs. Lee, Ralph Lee, C. G. Backus, A. P. Munning 2nd, Ed. Gleason, Bill Schneider, Mrs. McCahan, Ralph McCahan, Mrs. Bayer.

Henry Mahlstedt, Joseph Downes and K. Schwartz in some serious conversation. Joe Downes was one of the speakers.

Left to right, John Oberender and Austin Wilson (Background); A. P. Munning 2nd, C. G. Backus, Phil Sievering (Foreground) "Red" Wilson seems to get everywhere.

Ralph Liguori (Background); Dave X. Clarin, Dr. C. B. F. Young and Ray Goodsell who travelled all the way from Milwaukee.

Byron Hogaboom found an economical nickel plating bath, at least from a nickel standpoint, on page 125 of the February 2, 1937 issue of the Patent Office Official Gazette. Eight reagents are listed in the formula but *no nickel salts are mentioned.*

• •

Add soubriquet recipients:

George Nankervis (Detroit) "Beau Brummel", Ditto *Charles Costello* (New Haven).

Derick S. Hartshorn, Jr. (Springfield) "I'd hitch-hike a 1000 miles to an A.E.S. Convention".

William Erskine (Rockford, Ill.) "Fred Astaire".

Dr. William Blum (Washington, D. C.) "A gentleman and a scholar".

Gus Jellinek (Chicago) "Rough and ready".

John Oberender (New Haven) "Now according to the constitution".

Franklyn J. MacStoker (New York) "I rise to a point of order".

Jack Tierney (Meriden, Conn.) "King of metaphors".

J. J. Bell (Nashville, Tenn.) "Now I have a problem—".

Theodore Eichstaedt (Detroit) "He always dots his i's and crosses his t's".

Walter Barrows (Toronto, Can.) "Semper fidelis".

Frank Hanlon (Chicago) "Preserve the status quo".

Clarence Van Derau (Mansfield, Ohio) "He calls a spade a spade".

• •

Dr. L. C. Pan, known to many members of the Electrochemical Society and the American Electro-Platers' Society, is now in Paris. Mrs. Pan is in the French concession in Shanghai and was located by the American counsel at Shanghai at the request of *Henry Levine* one of the mainstays of the N. Y. Branch of the A.E.S. The following excerpts from a recent letter from Dr. Pan to Henry Levine shows the bitterness engendered by the Japanese attacks:

"Dear Mr. Levine:

I wanted to write you sooner, but I do not often get the freedom to do so. During the past several months, my work required me to do a great deal of traveling. Now I am in Paris on Government business. I may stay here for a few months. I like to come to the United States to see my old friends, but at present at least, I cannot arrange for the trip across the Atlantic.

The war in China has gone from bad to worse. There is not a city or town that is safe from attacks from the air. I have been to many places during the past several months; everywhere I went I met air raids by Japanese bombing planes. The Japanese are systematically bombarding . . . etc. I was reading the Readers' Digest (Oct. 1938) the other day and noticed that the American reading public was rather skeptical about accounts of Japanese atrocities in China. Indeed such brutality and savageness are beyond comprehension of a civilized people . . . How are Mrs. Levine . . .

With seasons' greetings, I am sincerely,
Lichi Pan."

Members of the Hanson-Van Winkle-Munning Company must have implicit confidence in each other as they recently held a bowling match between the Matawan "pinbreakers" and the Chicago "demolishers." Matawan won the match, with *Charlie Yerger* being the "fair-haired boy" with a high score of 241 (so he claims) with everything strictly on the level, including the alleys.

• •

The mail brings in some humorous bits from time to time among the many requests for information. One person recently asked me to send "all there is to know about plating". Another wanted to know why we didn't list "Gutter Percher" in our Buyers' Guide (probably phonetic spelling for gutta percha). A subscriber on the Pacific Coast wants to know how to plate "herbimium". If herbimium is a definite entity then there must be a void in the Yale curriculum as we have never heard about it and would be strongly tempted to look in a botany book for it. Perhaps "herbimium" is related to "manurium" plating so actively discussed by Dr. Ken Graham, Prof. E. Baker, Carl Huessner and the writer at the 1938 Milwaukee Convention. Lux et veritas.

Walter K. Meyer

NEW EQUIPMENT AND SUPPLIES

NEW PROCESSES, MATERIALS AND EQUIPMENT FOR THE METAL INDUSTRY

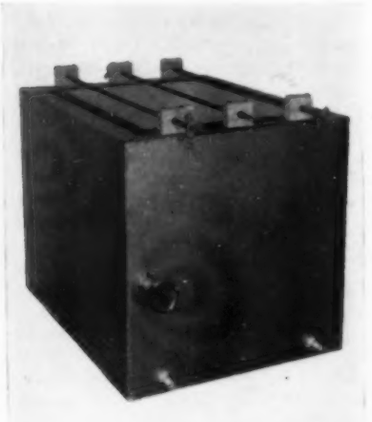
New Gold Plating Unit

Munning & Munning, Inc., 202-208 Emmett Street, Newark, N. J., have placed on the market an improved gold plating unit as illustrated by the accompanying photographs.

This apparatus, with thermostatic attachments, is designed to give the user more rigid control of the gold plating solution with a

resultant deposit of closer grain and more uniform color, as well as economies in materials used.

The gold plating unit assembly consists essentially of an insert tank, triple porcelain lined, surrounded by a sturdy welded steel jacketed tank housing the water bath. The jacketed tank is provided with a steam coil of adequate capacity for heating the water bath.



Temperature and water gauges, advantageously placed, afford convenient means for accurate control of these factors. The jacketed tank can be drained by means of an outlet.

The unit is equipped with a 3-conductor bar system, insulated from the tank by porcelain insulator cleats.

These units are available in all practicable capacities for gold plating.

New Protective Coating

A new protective coating called *Impervium*, developed by one of America's largest research laboratories has been announced for sale by Paramount Rubber Service, Inc., 1430 Rosedale Court, Detroit, Michigan. This coating is said to be an unusual combination of synthetic resins and can be applied at the home factory or in the field by experts of Paramount Rubber Service, Inc. When applied to metals *Impervium* is reported to protect the surface from all depreciation by acids, alkalis or oils. It may be applied to concrete, porous materials, including fabrics and all plating equipment.

Impervium is flexible, elastic and in the thin film is as soft as silk. It is also recommended to the electrical industry because of its high dielectric value and resistance to corrosive agents and oils.

A special testing unit together with a descriptive bulletin will be mailed to all inquirers who use a business letterhead.

New Automatic Polishing and Buffing Machine

The Packer Machine Company of Meriden, Conn., announces the Packer-Matic, a new rotary type, 5 work-station machine of an entirely new and radically different design to be known as Packer-Matic No. 4.

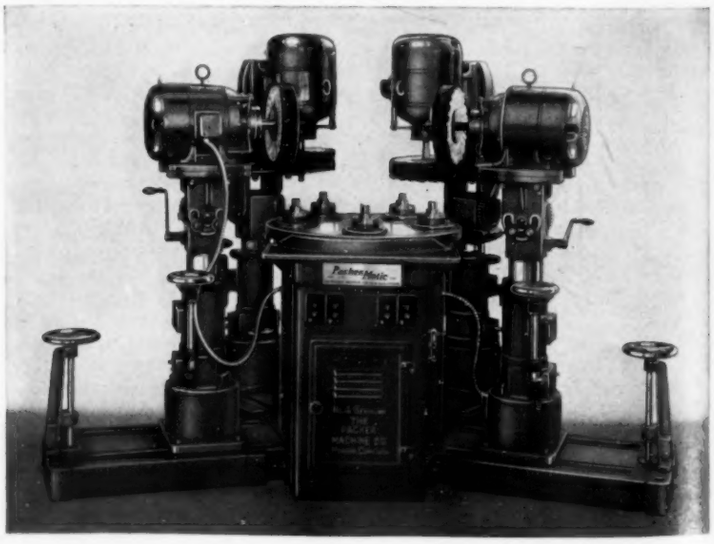
The conspicuous feature of the Packer-Matic No. 4 is the smooth looking main pedestal. In this pedestal is housed the motor drive variable speed unit, the oil reservoir for all moving parts beneath the work table and all the electrical push button controls—centralized operation.

The new design is made so that all moving working parts beneath the work table are completely enclosed, guarded against dirt and abrasive dust. The moving parts beneath the work table, operating in a bath of oil, are accessible by merely removing a tray at the operator position. The tray also serves as a convenient table for the operator while handling work.

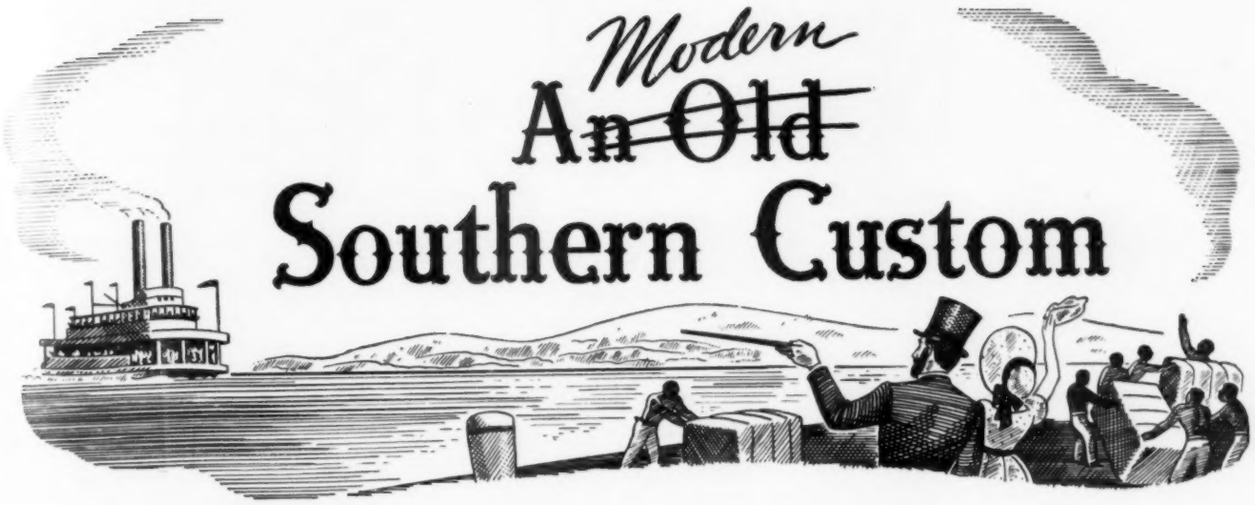
Centralized operator control is claimed to be an important time and labor saver in the Packer-Matic—individual control for each motor, emergency control switch for all motors—all conveniently located within easy reach of the operator from his position in front of the pedestal.

The wheel capacity has been increased 25%, and the wheel stands are individual units and can be quickly attached and detached dependent upon customer's requirements. The new No. 4 can be furnished with from 1 to 4 wheel heads stands with either wheels mounted directly to motor spindle or with multi-V belt driven ball bearing wheel spindles, permitting changing of speeds for the wheels. The speed of the work table can be operated at a ratio of 3 to 1, by the adjustment of the hand wheel control near the operator position. Maximum diameter of the work to be polished or buffed has been increased from 8 to 12 inches on the new No. 4. All bearings throughout are of the anti-friction type.

The Packer composition applicator for automatically applying composition can be supplied for all Packer-Matic automatic polishing and buffing machines.



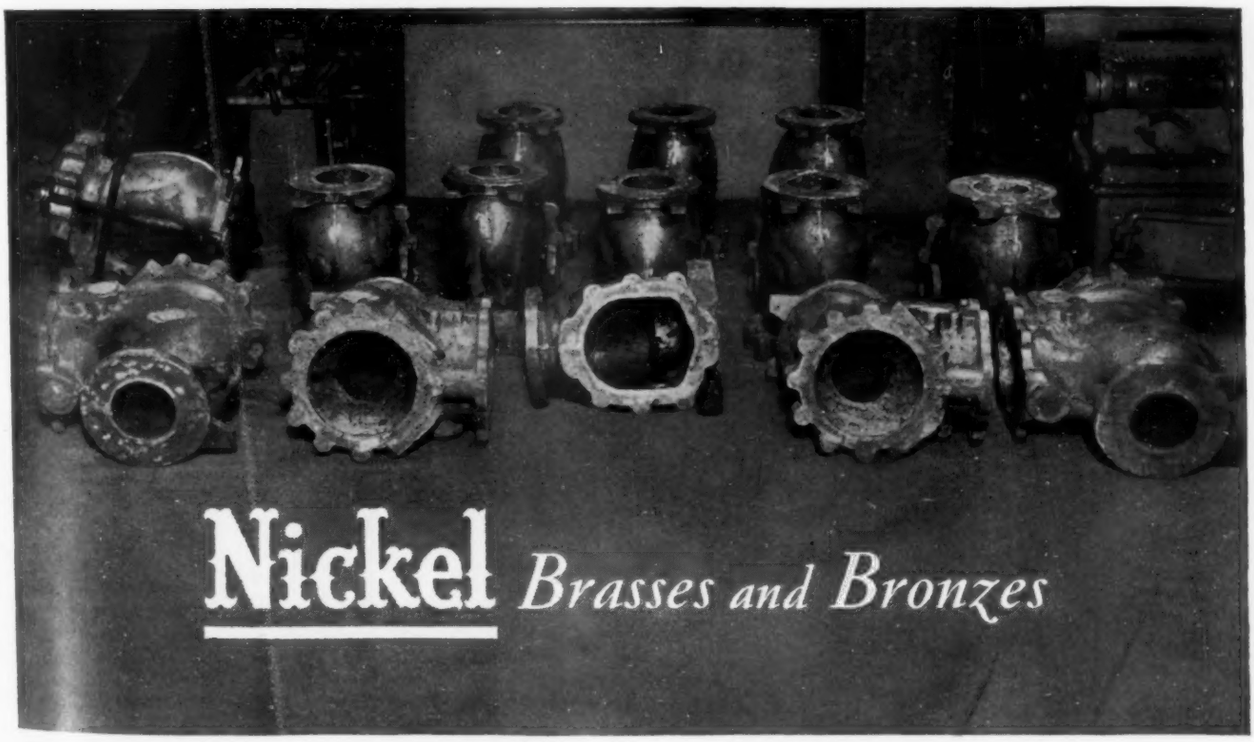
New 5 work-station automatic polishing and buffing machine.



Modern ~~An Old~~ Southern Custom

Nowadays progressive foundrymen rely upon Nickel to minimize shrinkage porosity and refine the grain of castings which must be pressure tight. Down in New Orleans, the F. H. Koretke Brass and Mfg. Co., cast these 6" water meter valves to withstand 225 lbs. pressure per square inch. Koretke uses an 88-10-2 "G" bronze mixture, modified by 1½% Nickel. • By replacing 3½% tin in this bronze composition with an equal amount of Nickel, similar castings will withstand more than 3,000 lbs. pressure per square inch. • The practical observation of many foundrymen has firmly established the fact that Nickel improves metal fluidity which aids in filling all parts of the mold and reduces rejections. By promoting a dense close-grained structure, Nickel assures pressure tightness of brass and bronze castings. • Improved pressure-tightness is but one of many money saving advantages Nickel offers you men who cast and use brass and bronze. Please write for more detailed information about money-saving applications of Nickel.

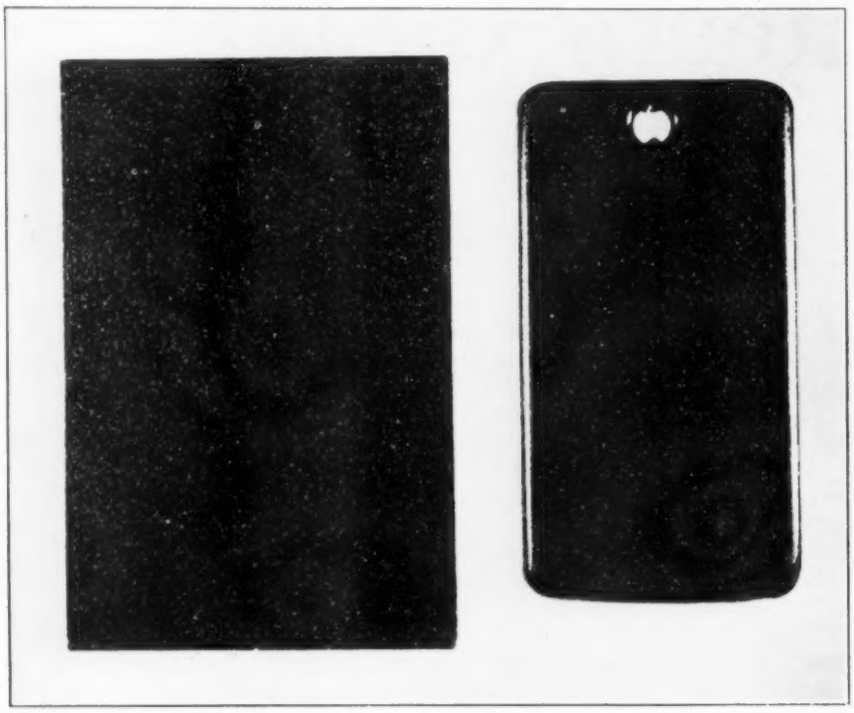
Water meter valve bodies weighing 275 lbs. each, cast by the F. H. Koretke Brass & Mfg. Co., New Orleans. Their "G" bronze composition was alloyed with 1½% Nickel.



THE INTERNATIONAL NICKEL COMPANY, INC., 67 WALL STREET, NEW YORK, N. Y.

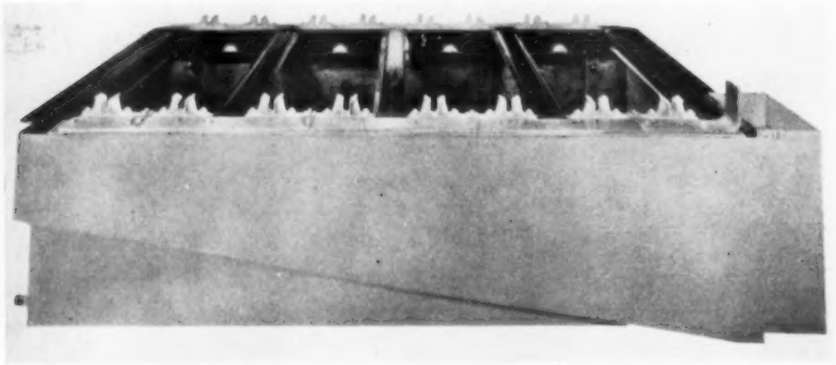
New Porcelain Enamel Finish

Of interest to space heater manufacturers will be the announcement of the Chicago Vitreous Enamel Product Company, Cicero, Illinois, of their newly developed porcelain enamel finish known as "Silverflake." This heater finish is claimed to provide all the durability and beauty of porcelain enamel at a markedly reduced cost for both material and production. Here-to-fore, porcelain enamel finishes have required first a "ground coat" followed by either one or two "cover" coats—each requiring a separate firing in high-temperature furnaces. "Silverflake" is merely a "ground coat" over-sprayed with a "silverflake" liquid. Being of this character a single labor application and a single firing is all that is necessary to provide a genuine porcelain enamel finish. The new finish has a dark color background which provides an excellent contrast for the "silverflakes." Both in actual use and in exhaustive laboratory research "Silverflake" has shown remarkable adherence and being inorganic porcelain enamel is immune to discoloration, heat corrosion, absorption, and is much easier to keep clean than "crackle" type finishes. It can be applied equally well to either cast iron or sheet steel.



Hot Solution Plating Barrel

A noteworthy advance in plating barrel construction is said to be embodied in the new Mercil plating barrel tank made by the Hanson-Van Winkle-Munning Co., Matawan, N. J., manufacturers of electroplating equipment and supplies. This tank which is designed for hot solutions, employs a unique method of exhausting the fumes. A series of small ducts directly over the anode rods connect with the main duct on the side. These individual ducts do not interfere with the placement of the cylinders into the tank in their respective saddle brackets, nor do they leave any unsightly cumbersome ducts along the side or above the tanks. The unit is neat in appearance, compact and thoroughly effective.

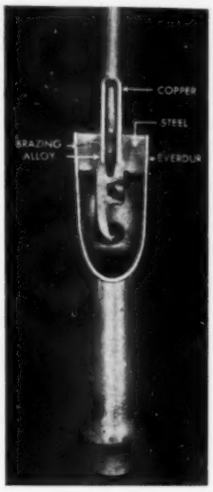


Plating Barrel Tank for hot solutions showing main exhaust duct at side which takes off from small ducts over the anode rods and leads the fumes out through a large flue.

Joining Everdur to Steel to Copper

Among the features which are bringing about a lot of interest in low temperature silver brazing is the ability of certain alloys of this type to make reliable joints between dissimilar metals.

The attached illustration is a good example of this point. It shows a cut-away section of an electric refrigerator part made up from Everdur, steel and cooper.



The outer shell of Everdur is brazed to a steel center section which at the same time is joined to a copper tube.

The alloy used is a low temperature composition having a medium silver content, known as Easy-Flo, made by Handy & Harman, New York. The work is done at the low temperature of 1175°F., using a flux that's fully active at 1100°F. The high strength of the bond and also its ductility make the completed assembly as sound and gas-tight in service as a solid piece of metal.

New Broaching and Machining Lubricant

The Wayne Chemical Products Company, Detroit, Mich., has recently developed a new compound, known as Aqua Sol "C" compound, for use as a broaching and machining lubricant. It is especially adapted,

Use of lubricant on a horizontal broaching machine.

PRODUCED TO SUBSERVE INDUSTRY'S NEED FOR HIGH QUALITY TANK EQUIPMENT - IN SINGLE TANK UNITS - OR COMPLETE TANK CYCLES

STORTS WELDING COMPANY-MERIDEN, CONNECTICUT

MANUFACTURERS OF HIGH QUALITY WELDED FABRICATIONS - TO SPECIFICATION

it is said, for use in broaching on both vertical and horizontal machines, and for lathes and other machines where a good machining lubricant is required. The illustration shows the compound being used on a horizontal broaching machine in the plant of the Detroit Broach Company.

Aqua Sol "C" mixes readily with water. The average solution is a mixture of 8 to 10 parts of water to 1 part of the base compound. Because of the small amount of the compound required to produce an effective solution, actual production tests, according to the manufacturers, have shown that savings of 25% to 400% on lubrication costs will be effected in the plants which are now using this compound. Being a water soluble solution, it is much more efficient for cooling purposes than oil lubrication. A better finish is secured on the parts being broached or machined.

One of the important features claimed for Aqua Sol "C" is its cleanliness. It eliminates all of the disadvantages of broaching oil and similar lubricants, which invariably spread over both the machine and floor and cover the hands and clothes of the operator. There is no extra time involved in periodic clean-ups around the machine and the man at the machine works under better and more pleasant conditions resulting in more productivity.

New Cooling Water Control

Sarco Company, Inc., manufacturers of steam specialities, 183 Madison Avenue, New York, announce the addition to their line of temperature regulators of the cooling water control illustrated, and known as type TR-40.

This new regulator has been designed expressly for use on the cooling water jackets of internal combustion engines and compressors. It can be employed also in connection with water cooling of solvent recovery stills in dry cleaning plants and on

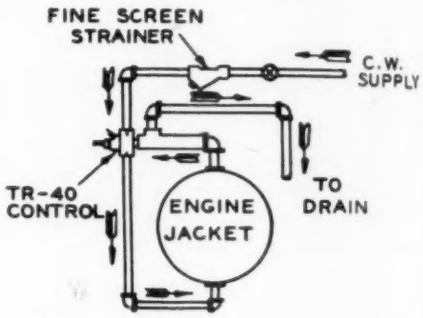


Diagram of use of cooling water regulator.

degreasers as used in metal manufacturing establishments.

The control consists of a piston valve operated by a liquid expansion thermostat to throttle the flow of controlling water as required to maintain a constant temperature. The valve is provided with a bleeder port adjustable from the outside. This serves to allow a small amount of cooling water to flow at all times even when the valve is closed. This also keeps the thermostat active and ready to respond.

An important innovation is a safety device in the form of a fusible plug inserted

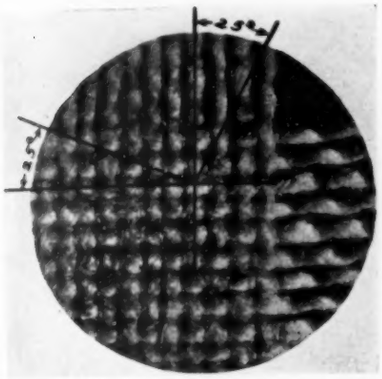
Diagram of cooling water regulator.

between the thermostat plunger and the valve spindle in such a way that in the event of thermostat failure, the plug will collapse and the water valve will be forced wide open. This makes impossible damage to the engine in the event of thermostat failure.

Sizes 3/8" to 1" are now available and larger sizes also are contemplated.

Chemically Treated Buffs

Hanson-Van Winkle-Munning Company, Matawan, N. J., has perfected a chemical treatment method which is said to make buffs last longer and stand up better against abrasive wear. These buffs are made of two types of square count cloth called "Economy" and "Tractor". The buffing cloths, as they come from the loom, are passed through a chemical bath. The



Tractor buff, chemically treated to stand abrasive wear. Magnification 25X. Note the twist in the horizontal threads, to an angle of 25°.

wear resistance developed by this chemical treatment is further increased by the carefully balanced construction of the buffing textile. It is stated also that the treated buffs absorb polishing composition better, giving improved cutting and coloring action on the product being buffed.

The chemicals used for treating the buffs include a hygroscopic element whose purpose is to absorb moisture from the air, fixing it in the cloth and giving a conditioned sheeting at all times.

Pneumatic Sanding Drum

Mall Tool Company, 7740 S. Chicago Ave., Chicago, Ill., announces an improved pneumatic sanding drum, the improvements including a new style fabric band and air tube. The construction of the drum, according to the manufacturers, has been improved in design and simplified for faster renewal of abrasive bands and allows for easier servicing. The pneumatic sand drum produces a smooth draw file finish on all

Pneumatic sanding drum.

metals and materials and can be used on all makes of flexible shaft machines, bench and aerial grinders as well as for continuous hard use on all sanding operations. It is claimed that a very smooth polished sur-

Use of pneumatic sanding drum for flexible shaft grinding.

Use of pneumatic sanding drum for bench grinding.

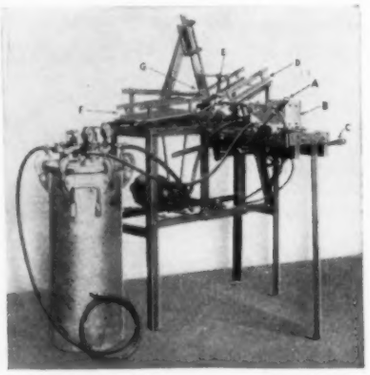
face is obtained by the soft air cushion which holds the abrasive firmly in place.

The pneumatic sand drum has a hub over which there is a clincher type inner tube to give softness and smooth running qualities, and over the tube a rubberized fabric band is placed. Suitable abrasives of different grits are placed on the outside of the fabric sleeve and are held in place by the inflation of the air tube.

Use of pneumatic sanding drum for aerial grinding.

Spray Machine

The Eclipse Air Brush Co., Inc., 390 Park Ave., Newark, N. J., has developed a machine for the semi-automatic spray coating of the inside of small cylindrical objects, such as paper or metal cans. The cylinders feed by gravity down an adjustable slide and are released by a manually operated lever onto a rotating device. A solenoid operated spray gun fitted with an extension nozzle is then moved forward to coat the inside, while the cylinder is being rotated. The gun is pulled back and the next cylinder comes down, pushing the finished one on its way. A one-sixth horse-power electric motor operates the automatic part of the equipment.



According to the manufacturers, an average production of 10,000 pieces per 8-hour day can be maintained with this machine.

New Centrifugal Enameler

Tolhurst Centrifugal Division, American Machine and Metals Inc., 100 Sixth Ave., New York City, has designed a new Tolhurst centrifugal enameler, which is said to enable manufacturers of small articles, such as cabinet hardware, electrical fittings and parts, springs, screw machine products, stampings, etc., to coat them efficiently and easily with enamel, lacquer, japan or rust preventing agents. Not only does the use of the centrifugal enameler accomplish the operation quickly, according to the manufacturer, but also a smooth even coating

New centrifugal enameler.

is procured, and the excess coating material completely recovered for re-use. Hollow or cupped articles can be handled readily without filling or clogging. Perforations and screw threads are produced uniformly clean, free of excess coating.

The machine itself consists essentially of a removable container, called the basket and a curb. The parts are placed in the basket, or for special types of work out on racks, and the basket set on a spindle within the curb. Sufficient amount of coating material is then allowed to flow in until the articles are completely covered. The machine is then closed and the basket set in motion. As the basket rotates, the centrifugal pressure developed, forces the coating material into every opening and over the entire surface of the parts. The thickness of the coating can be easily controlled. No special grade of lacquer, enamel or rust preventing agent is required.

The new machine is made in four stand-

ard sizes ranging in capacity from one to fifteen cubic feet of parts per load. Up to twenty loads per hour are possible, it is claimed.

New "High-Speed" Synthetic Enamels

A new line of synthetic enamels, with very short baking schedules, has just been placed on the market by Maas & Waldstein Co., makers of industrial finishes, Newark, New Jersey.

These new finishes, which are known as "Polydur" enamels, were developed to enable manufacturers speed up production by reducing the time needed for finishing their products.

Polydur enamels set out of dust in a few minutes. Their baking schedules depend upon the temperature employed, but, at 325° F., they bake to a fine finish without discoloration in 15 minutes. The finish is very durable, and resistant to marring, moisture, and ordinary household chemicals. Polydur finishes are supplied in white and all colors, for spraying or dipping.

New Cleaner for Bright Nickel

The Frederick Gumm Chemical Company, Inc., 538 Forest Street, Kearny, N. J., has announced the development of an alkaline cleaner for removal of oil and carbon smut from steel, which is claimed to be particularly suited for preparation of steel previous to bright nickel plating.

The cleaner may be used with direct or reverse current or a combination of both, and it is claimed that concentrations above 6 ounces per gallon are unnecessary.

The manufacturers claim that this cleaner has undergone extensive laboratory and commercial tests extending over a year.

Streamlined Spray Gun

A streamlined spray gun has been recently announced by the Electric Sprayit Company, 220 N. Broadway, Milwaukee, Wisc.

This gun is used in conjunction with portable compressors for general maintenance painting for refinishing as well as for small production work in industrial plants. The gun is regularly furnished in two styles, either as a pressure feed gun with round, fan and angle spray internal mix spray nozzles or as a syphon feed gun with external break-up nozzle that provides both fan and round spray patterns from the same nozzle. Both styles of guns may be converted instantly from bleeder to non-bleeder types, thus making them both equally suitable for use on both portable compressors and air lines.

The entire spray gun body and removable cover are made of die cast aluminum and the container is also aluminum, of one quart capacity. As a result, this gun is light in weight and this factor, coupled with the fact that the handle of the gun is comfortably shaped in true revolver grip fashion, permits great ease in handling the gun, and provides tireless operation. The gun may be used with pressure paint tanks as well as with the quart container by removing the container and cover.

Streamlined spray gun with self-contained oil and moisture filter.

Another feature of the spray gun is the self-contained oil and moisture filter built integrally into the handle of the gun, which removes the last vestige of oil and moisture from the air and thus protects the finish from defects caused by contamination of the air. This filter is equipped with a drain valve at the bottom of the handle, through which the accumulated oil and moisture are drained off periodically.

All working parts of this spray gun are enclosed, thus eliminating any possibility of clogging these parts with paint, all controls being located at the back of the gun. All air nozzles and fluid tips furnished with this gun are made of case-hardened steel thus preventing wear and distortion of the spray.

Portable Electric Belt Sander

A nine-pound portable electric belt sander has been developed by the Syracuse Guild-Tool Company, Syracuse, N. Y. This new power tool was especially designed to make available to the average workman the advantages of the belt-type sander, and it is said, to eliminate the costly hand sanding, surfacing and refinishing. It is known as the GuildSander, Type A-2.

Light in weight, the GuildSander is usable in any position, and to do all types of sanding, and is claimed, to sand all straight or slightly curved surfaces. The front pulley may be used as a spindle sander. It can be used where paints, varnishes and other surfacing materials have to be removed.

In addition to its utility on wood and metals, it may be used on slate, plastics and composition materials or to polish and hone marble or other minerals; also to do light grinding on straight-grain metal, and will sharpen hand tools.

It is built with a die-cast aluminum frame, finished in baked aluminum enamel. The abrasive belts are of the endless type and travel 600 ft. per minute. They are 2″ wide by 21″ in circumference, and are furnished in all usable grits. They may be changed instantly by means of a patented new catch-and-release spring plate.

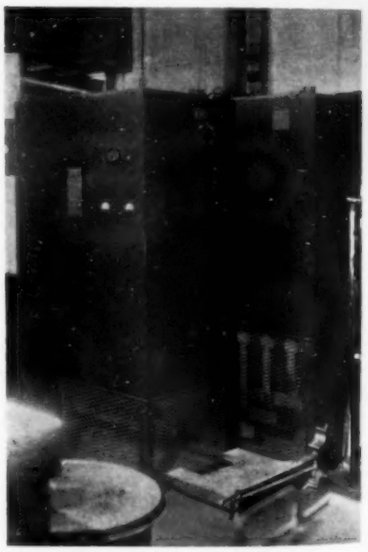
The GuildSander is equipped with 110-volt universal motor that plugs into any light socket, either A. C. or D. C.

Portable electric belt sander.

Copper Oxide Rectifier for Electrotyping

The Shane-Beever Company, Baltimore, Md., has installed a new type of electrical equipment, namely a copper oxide rectifier to supply the current used in the deposition of copper and nickel electrotypes. This is said to be the first large installation in the United States in this industry.

The use of the rectifier, made by the Hanson-Van Winkle-Munning Company, Matawan, N. J., involved a change from the use of motor-generator sets and also a change from the use of direct current to alternating current for the power supply. One copper oxide rectifier of 3,000 amperes, 6 volt capacity replaced two 1,500 ampere motor-generator sets with DC motors. The new combination is claimed to have resulted in appreciable savings in power bills with an installation cost about one-half the cost of installing a motor-generator set. The maintenance cost is said to be very low,



Copper oxide rectifier used for supplying current for electrotyping.

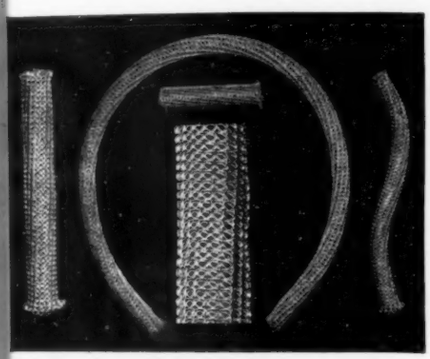
mainly because the rectifier has no moving parts and requires practically no attendance. The Shane-Beever Company has found this equipment ideal for an electrotyping shop which normally has no electricians on its staff.

The copper oxide rectifier, accomplishes the rectification or conversion of alternating current into direct current by leading alternating current to a suitable step-down transformer which changes it to low voltage, high amperage alternating current. This low voltage alternating current is led to the rectifier plate assemblies, a series of copper plates which have been oxidized by a special heat treating process so that they have

a uniform, dense and highly adherent coating of copper oxide. It is at the contact surface of the copper and copper oxide that rectification takes place. The direct current is led out of the rectifier by requisite leads to the equipment using it, in the instance described above, the electrolytic solutions of copper and nickel for producing electrotypes.

Knitted Wire Flexible Tubing

E. H. Titchener & Company, Walnut St. & Erie R. R., Binghamton, N. Y., have announced the development of a new product —knitted wire, which they claim is ideally suited for knitting into seamless tubing. The knitted wire is made of rows of resilient loops, which are interlocked with other rows, thus forming a continuous seamless tube and accomplishing this result with only one strand of wire.



Tubing of knitted wire made with one strand of wire by interlocking loops.

Wire of varying gauges can be used and the tubing can be manufactured in many diameters and in almost any length. One combination of wire gauge, mesh size and diameter will produce a tube of great flexibility while another combination will make tubing which has rigidity and when bent or formed will retain any desired shape or position.

The knitted wire can be plated, rustproofed, enameled or coated similar to any other bright steel products, and it also can be covered with rubber, silk or any other fabric.

The suppliers recommend its use for decorative and display fields, as a protective covering for hose or hose connections, on light cords on electric appliances, for nonslip grip for tool handles, etc.

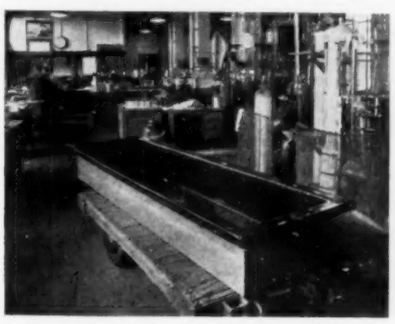
Koroseal-Lined Tanks

Rubber as a lining material for pickling and storage tanks has made possible many important improvements and economies in the acid handling industries. However, the use of rubber in this field is restricted because of its vulnerability to most of the highly corrosive acids. Recognizing these limitations, engineers of the B. F. Goodrich Company, Akron, Ohio, have, for several years, been carrying on exhaustive experiments with linings made of the synthetic rubber-like material known as Koroseal with the result that two different types of construction have been found acceptable.

The result is a tank lining, which it is reported, will successfully handle hydrofluoric, nitric, chromic, sulphuric, and mixed nitric acids as well as nickel and other plating solutions. The only acid Koroseal will not handle is acetic, and this presents no problems as hard rubber proves most suitable for this purpose.

Approximately 32 Koroseal-lined tanks have been installed for a wide range of service during the past two years. One of these units is used for the continuous strip pickling of stainless steel. The Koroseal-lined tank has now completed two years of service, during which time, according to the manufacturers, it has shown no signs of leakage, required no repairs.

Koroseal lining can be applied to wooden, concrete or steel tanks in one of two forms. The most common method is to line the tank with a special fabric which is then treated with a Koroseal solution. This construction requires no vulcanization and will withstand temperatures up to 212° F. The other method consists of lining the tank with



Tank lined with sheets of Koroseal will withstand temperatures up to 150° F.

sheets of Koroseal (see illustration). This type of lining requires the use of heat-sealing methods and is capable of withstanding temperatures only up to 150°F.

A. C. Electric Welder

Hampton Electric Tool Co., 700 Walnut St., Edgewood, Pittsburgh, Pa., announces a new Model E Hampton AC Electric Welder for which is claimed a welding range of 20 to 280 amperes with any size electrode from 1/16" to ¼".

The instrument has a single dial control for instant choice of the proper welding amperage, operates at either 110 or 220 volt A.C. current with facilities for rapid changing from either voltage.

A.C. electric welder.

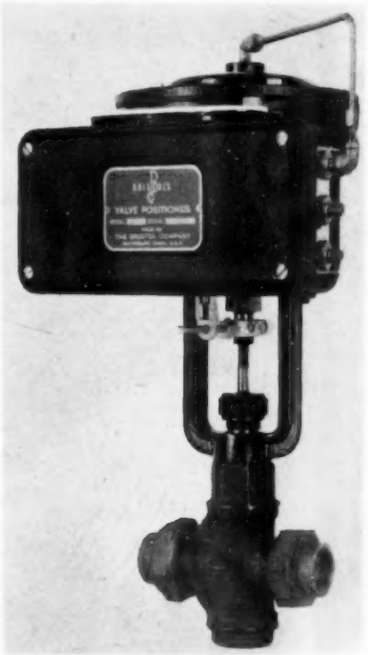
A New Primer

The American Asphalt Paint Co., 43 E. Ohio St., Chicago, Ill., has announced the development of a new paint product called Valdura No-Rust primer, which is said to eliminate the necessity of cleaning rusty surfaces of the bare metal before painting.

Applied directly over rust, this clear light liquid is reported to penetrate into the surface, surrounding each rust particle and prevent further oxidation. Its greatest value is claimed to be on those metal surfaces that are inaccessible to cleaning by power means or on those surfaces requiring tedious wire-brushing. The primer is made from a processed tung oil and other special sealing oils that are claimed to prevent the spreading of rust and the bleeding of the rust through the top coat of paint. The manufacturers state that test applications of these paints over this primer on rusted tin, galvanized iron and rust pitted iron coatings and steel plate have all held up over a period of years; in some cases extending back to 1931.

New Valve Positioner

The Bristol Company, Waterbury, Conn., announces the development of a new Valve Positioner for use on Diaphragm Control Valves to overcome the effect of friction in the valve stem and top. This pneumatic device is recommended for use on all air-operated control installations where close control is of paramount importance and particularly on those where there is considerable process lag.



Valve positioner for use on diaphragm controlled valves.

This Valve Positioner assures a proportionate valve stem travel for even the slightest change in the pressure of the air from the controller. Any friction that might tend to prevent the valve disc from coming to its intended position in order to maintain close control is completely overcome.

New Liquid Soldering Flux

Industrial Service Laboratories, 915 W. Oklahoma Ave., Milwaukee, Wisc., have announced a new liquid soldering flux, Special X, particularly intended for "difficult to solder applications". This flux can be used on brass, copper, cadmium, stainless steels, zinc, Monel, iron and many other alloys.

Research was particularly undertaken to provide a better flux for builders and fabricators of alloy steel and Monel equipment, but results, according to the manufacturers, have shown that it works unusually well in production or "line" soldering of toys, expansion valves, electrical controls, small pressure tanks, restaurant equipment, milk coolers, lighting fixtures, etc.

Lowered surface tension and good wetting power of flux cause quick and uniform flow of solder into all cracks and crevices.

Manufacturer will supply working sample and technical data upon receipt of request on company letterhead.

Temporary Protective Coating

Haydn F. White & Company, 1740 E. 12th Street, Cleveland, Ohio, has developed a new type of material called Protex, for use as a temporary protective coating on stainless steel and other highly finished metals in the process of shipping, fabrication or assembly.

One of the many advantages claimed in using Protex No. 102 is the fact that it does not require a paper covering as is the case with most other types of temporary coatings. A thin coating applied with brush or spray gun will safeguard delicate surfaces against scratches or other damage throughout shipping, fabrication and assembly.

Removal of the Protex coating is easily and quickly accomplished by saturating the coated surface with warm water and allowing it to soak for two or three minutes.

Manufacturers' Literature

New and Revised Literature on Electroplating. Cadalyte "38"—a manual giving recommended methods of preparing, controlling and analyzing the solution; *Electrotinning*—manual bringing up to date recommended practices for the operation of sodium stannate-acetate electrotinning process; *Carbonate Remover*—the effect of carbonate on cyanide plating solutions, the determination of carbonate and its removal are discussed; *Electroplating Chemicals*—a booklet treating in brief form the chemicals, processes and materials for electroplating; *Carburizing Salt*—a technical service bulletin describing a new development—duPont carburizing salt for the production of deep high-carbon cases on plain carbon and alloy carburizing steels; *Accelerated Salt*—bulletin describing the new cyanide mixture of uniform composition for the production of mixed carbon-nitrogen cases on plain carbon and alloy carburizing steels.

Cleaning Bulletin No. 227. A new price list and bulletin for industrial brush plating have been put out by Portable Plating and Equipment Co., 1000 S. Michigan Ave., Chicago, Ill.

Single-Cam Cycle Controller. A bulletin devoted to Bristol's model 6089V single-cam cycle controller. The Bristol Company, Waterbury, Conn.

Air-Operated Control Valves. In this bulletin, No. 514, the fundamental principles of design of the various types of valves supplied are given, as well as the operating characteristics of Bristol's Synchro-Valve Top; directions are included for ordering or specifying these valves. The Bristol Company, Waterbury, Conn.

News Service, January-February 1939, Vol. XXIII Nos. 1-2. This booklet covers "Three Decades of Scientific Attention to Industrial Cleaning Methods"—1909-1939; illustrated. Oakite Products, Inc., 22 Thames St., New York City.

Wide-Strip Pyrometers. A catalog presenting information regarding the entire line of Wide-Strip pyrometer recorders and controllers manufactured by The Bristol Company, Waterbury, Conn.

Abrasives. Booklet containing information on CBT Lionite, EPT Lionite, ST Lionite and NB Lionite abrasives; illustrated. The General Abrasive Co., Inc., Niagara Falls, N. Y.

Engineering Properties of Nickel. Bulletin T-15. This bulletin contains extensive tabulated data on the mechanical properties and physical constants of nickel. International Nickel Co., Inc., 67 Wall St., N. Y. City.

Power Squaring Shears. Bulletin BL, illustrating and describing 10 gauge power squaring shears, particularly the massive box section bed. Niagara Machine & Tool Works, 637 Northland Ave., Buffalo, N. Y.

New Compounds For Welding. A folder on two new metal coatings, known as Flash-Ex and Spatter-Ex which prevent adhesion of welding spatter. Wayne Chemical Products Co., Copeland at M.C.R.R., Detroit, Mich.

Portable Hydraulic Welding Equipment. This folder describes and illustrates Progressive hydraulic welding and punching equipment. Progressive Welder Co., 737 Piquette Ave., Detroit, Mich.

New Temperature Indicator. Catalog N-33A (5), 1939, discusses a new switchboard-model temperature indicator with self-contained toggle-type switches. Leeds & Northrup Co., 4901 Stenton Ave., Philadelphia, Pa.

"*Tools of* 1001 *Uses*". A catalog giving information on, and illustrating, Handee tools. "Wherever there is an electric outlet, a shop can be set up with these tools". Chicago Wheel and Manufacturing Company, 1101 W. Monroe St., Chicago, Ill.

Abrasive Grain Data Sheet No. 1, *Form ESA59*, containing descriptive information and specification of the four types of Borolon (aluminum oxide) abrasive polishing grain. Abrasive Company, Philadelphia, Pa.

Rust Prevention for Iron and Steel. A new book, describing recent improvements in Parkerizing, and its adaptability to a wide range of products is ready for factory executives and technical men. Parker Rust-Proof Co., Detroit, Mich.

Hose. An illustrated catalog containing full information on the DeVilbiss line of hose for all requirements. This literature traces the product from the baled crude rubber through the DeVilbiss hose factory and testing laboratory to its various finished forms. The DeVilbiss Company, Toledo, Ohio.

Oil Flow Control Valve. Leaflet No. 387 discussing the Rockwell Angle Flow Control Valve. W. S. Rockwell Co., 50 Church St., New York City.

Gas Burning Equipment. Catalog No. 802 covers the low pressure air induction mixers; catalog No. 803, the high pressure gas inspirators with streamlined air flow, and catalog No. 804 covers Retain-A-Flame nozzles; also Sealed-In gas burner nozzles. Hauck Manufacturing Co., 124-136 Tenth St., Brooklyn, N. Y.

High Temperature Cement. Catalog HC 501 featuring Hytempite, a plastic air-setting high temperature cement for bonding brick and shapes. Quigley Co, Inc., 56 W. 45th Street, New York City.

Process Steam Traps. Bulletin No. 1200D is devoted to descriptions of Series 78 Thermostatic Traps; Series 79 Float-and-Thermostatic Traps; Series 7-M Thermostatic Traps, and Series 78 Dirt Strainers. Warren Webster & Co., Camden, N. J.

New Books

American Society for Testing Materials. Size 9¼" x 6¼"; 1388 pages.

This volume includes the technical papers presented at the Annual Meeting of the A. S. T. M., held at Atlantic City, N. J., June 27-July 1, 1938.

It includes the Edgar Marburg Lecture by the late Dr. Albert Sauveur, on the Torsion Test; a symposium on impact testing; over twenty papers on physical metallurgy; eleven papers on concrete, cement, ceramics, etc., and a group of eighteen miscellaneous papers including "Adherence of Organic Coatings to Metals", by A. E. Schuh.

Copies may be purchased from the American Society for Testing Materials, 260 S. Broad St., Philadelphia, Pa.

American Society for Testing Materials. Proceedings of the Forty-first Annual Meeting, held at Atlantic City, N. J., June 27-July 1, 1938. Volume 38. Part II. Technical Papers. Size 9¼" x 6¼"; 674 pages. Copies may be secured from the American Society for Testing Materials, 260 S. Broad St., Philadelphia, Pa.

Magnesium and Its Alloys, by J. L. Haughton and [illegible] E. Prytherch. First American edition. Published by Chemical Publishing Co., N. Y. Size 8¾" x 5½"; 100 pages. Price $[illegible].

This book has been prepared as a result of the increasing demand for lightness in construction and because of the great amount of research which has been undertaken on magnesium alloys. This book has been prepared under the Metallurgy Research Board of the Department of Scientific and Industrial Research, under whose guidance work has been proceeding at the National Physical Laboratory of England, for a number of years.

The book is very concisely written, giving a vast amount of information on this subject. The chapters are: Magnesium, Its Sources, Production and Properties; Melting and Casting; The Plastic Deformation of Magnesium and Its Alloys; The Rolling, Forging, Extrusion and Heat Treatment of Magnesium and Its Alloys; The Mechanical Properties of Magnesium Alloys at Room Temperature; The Mechanical Properties of Magnesium Alloys at Elevated Temperatures; the Constitution of the Alloys of Magnesium.

The inclusion of all of the available equilibrium diagrams of magnesium with other metals is especially valuable.

Cellulose Lacquers, Finishes and Cements, by Arthur Jones. Published by J. B. Lippincott Co., Philadelphia, Pa. Size 9" x 6"; 410 pages. Price $6.30.

The author has had long experience in the subject about which he has written and presents the British side of the field of cellulose lacquers. This book will be found of value to the user of lacquer as well as to those people working on lacquer formulations. Each phase of the lacquer industry has been considered and some of the chapters are: Historical; Lacquer Technique; Plasticisation; Lacquer Formulation; Lacquer Film Tests and Analysis; Solvents, Diluents, Plasticisers and Softeners; Cellulose; Resins and Varnish Gums; Pigments; Thinners; Undercoats; Brushing Lacquers and Enamels; Cellulose Leather Finishes; Cellulose Cements; Fabric Finishes; Industrial Finishes; Application of Lacquers, Enamels and Cements.

The format as well as the illustrations are typically British but this in no way should interfere with the value of this book for American readers.

Plastic Working of Metals and Power-Press Operations, by E. V. Crane. Second Edition. Published by John Wiley & Sons, Inc., New York City. Size 9" x 6"; 440 pages. Price $5.00.

The second edition of this excellent book has clarified and expanded details of the plastic working theory, and added to the discussions are many of the working operations discussed in the first edition.

The chapters include: Mass Production; Essential Metallurgy; Shearing Metal in Dies; The Shearing Group of Press Operations; Bending Operations; Expanding, Contracting and Curling; Cold-Working of Plastic Metals; The Drawing Group of Press Operations; Drawing Speed, Lubrication, Annealing; Cold Operations of the

Squeezing Group; Extrusion; Hot Press Forging; Press Characteristics and Modifications; Automatic Production; Graphical Computations and Tables; Problems.

The book is very well written, printed and illustrated, and contains a vast store of information on almost all phases of commercial metal working. In the appendix, the author has added methods for graphical computations of such subjects as flywheel energy, press capacities, pressures, drawing reductions, etc.

Associations and Societies

American Electro-Platers' Society

Anderson Branch

The February 6th meeting of the Branch was called to order by vice-president *C. F. Hauri.*

R. O. Hull of the DuPont Company spoke on "Plating Methods of 1939", and illustrated the vast changes and improvements that have taken place in the plating of cadmium, zinc and copper within the last few years. The talk was illustrated with lantern slides and samples of plated ware.

Baltimore-Washington Branch

Approximately sixty persons were present at the annual educational session and one hundred and ten at the dinner, which was held on February 4th.

The speakers were:

H. Leroy Beaver, Abbott Ball Co., Hartford, Conn., "Barrel Finishing of Metal Products".

Edwin C. Rinker, Oakite Products, Inc., N. Y., "Plating of Jewelry Novelties".

F. Fulforth, Proctor & Schwartz, Inc., Philadelphia, Pa., "Constructive Pre-Plating Methods".

R. H. Kittner, American Hard Rubber Co., N. Y., "Applications of Rubber in Plating".

W. M. Phillips, General Motors Corp., Detroit, Mich., "The Story of a Grill".

Some of the visitors from other branches were:

Joseph L. Downes, New Haven, Conn.
Ray M. Goodsell, Milwaukee, Wisc.
W. J. R. Kennedy, Springfield, Mass.

Bridgeport Branch

R. H. McCahan of the Electroplating Division, E. I. duPont de Nemours & Company, addressed the Bridgeport Branch of the American Electro-Platers' Society on Friday evening, February 17, in the breakfast room of the Stratfield Hotel. Mr. McCahan took for his subject "Copper Plating from Cyanide Solutions."

Following the address, Mr. McCahan conducted a symposium on electroplating at which he answered questions of those present. There were over 100 members and guests present.

The speaker at the March 17 meeting will be *H. Leroy Beaver,* whose subject will be, "Barrel Finishing of Metal Products".

Chicago Branch

The annual educational session and banquet, held on January 28, was an outstanding success, with several hundred present at the educational session, and over eight hundred present at the banquet and dance in the evening.

The speakers at the educational session were:

W. M. Phillips, General Motors Corp., Detroit, Mich.

Floyd Oplinger, E. I. duPont de Nemours & Co., Niagara Falls, N. Y.

G. A. Stocker, Seymour Manufacturing Co., Seymour, Conn.

Walter Pinner of the General Spring Bumper Corp., Detroit, Mich.

Detroit Branch

The March 3rd meeting was addressed by *H. Leroy Beaver*, consultant, Lansdale, Pa., who spoke on "Barrel Finishing of Metal Products," and the April 7th meeting will be addressed by *Burton G. Daw*, vice-president, LaSalco, Inc., St. Louis, Mo., who will give a practical demonstration in a talk entitled, "What Happens in a Plating Barrel."

Milwaukee Branch

The date of the annual educational meeting and banquet has been changed from April 22 to April 29. The meeting will be held at the Schroeder Hotel, Milwaukee, Wisc., and the following Committee has been appointed:

Jack Geisman, Chairman.
Robert Steuernagel, Secretary-Treasurer.
Henry Bornitzke, Educational.
Dan Wittig, Publicity.

Newark Branch

The speaker at the March 3rd meeting of the Newark Branch was *Franklyn J. MacStoker*, whose subject was "Electrodeposits on Glass Reflectors and Mirrors", and on March 17, *R. O. Hull*, E. I. duPont de Nemours & Co., Cleveland, Ohio, will address the branch.

New York-Newark Branches

A successful joint technical session and banquet was held on Saturday, February 18, at the Hotel Pennsylvania in New York. Over one hundred and fifty members attended the educational session which was presided over by *Dr. C. B. F. Young*. The speakers and their subjects were:

Joseph L. Downes, Remington-Rand Co., Middletown, Conn., "Why I Am A Member of the American Electro-Platers' Society".

Joseph Haas, The Bassick Co. Bridgeport, Conn., "The Application of Scientific Management in the Plating Room".

Frederick Fulforth, Proctor & Schwartz, Inc., Philadelphia, Pa., "The Educational Program and Policy of the American Electro-Platers' Society".

Dr. C. L. Mantell, Consultant Chemical Engineer, Brooklyn, N. Y., "A History of the Electrochemical Industry".

The banquet and dance in the evening was attended by approximately four hundred members and guests.

Toronto Branch

The Branch was recently given a talk on "Distillation" by *Bert Gribble* of the Hiram Walker Company, and on February 27 moving pictures were shown on "Filter Aids," with a talk by *F. C. Honey* of the Johns-Manville Company.

All members of the branch are requested to bring a few plating racks at the March meeting, at which time *Archie Smith* will give a talk on "The Study of Plating Racks".

American Foundrymen's Association

New York-New Jersey Chapter

A joint technical meeting with the Newark Chapter of the American Society for Metals, will be held on March 20.

Mr. Briggs of the Steel Founders' Society will speak on "Steel Castings".

American Welding Society

The 11th Lecture of the Evening Lecture Course of the New York Section, will be entitled "Design of Welded Piping" by *A. W. Moulder*, vice-president, Grinnell Company.

The Lectures are held at Polytechnic Institute of Brooklyn, N. Y., and start at 6:45 PM.

Obituaries

William Sherwood

William Sherwood, president of Sherwood Brass Works and one of its founders, was buried January 23 at Detroit. Mr. Sherwood was born in Lincolnshire, England, in 1851, and had lived in Detroit 68 years. He started in business in 1893 as the Buick Sherwood Mfg. Company, with David Buick, founder of the Buick Motor Company as a partner.

George W. Goudy

George W. Goudy, general representative, foreign manager and director of the Philadelphia Quartz Company, Philadelphia, Pa., died February 7, in his sixty-ninth year, at his home in Highland, Ulster Co., N. Y. He had been associated with the company over forty years, having first served in the capacity of a salesman, assisting his father, Charles W. Goudy, who was traveling representative. His early experience as a soap manufacturer well fitted him for the position of aiding his father in validating the merits of silicate of soda, particularly in the manufacture of soap and paper.

Through more than 40 years of business life with the company, he saw the development of wider usefulness of the sodium silicates and, in the twentieth century, contributed greatly to the establishments of the fiber box as a standard shipping container.

His advice was constantly sought by friends in and out of business circles and so he became "Uncle George" to a great number of people from coast to coast, in Europe, in South America and across the Pacific.

During the last year and a half, illness had prevented him from being active in his official capacity with the company.

He is survived by his wife, Mildred Ritz Goudy and two sisters, Miss Arvilla Goudy and Mrs. Chas. S. Woodruff.

John J. Corcoran, treasurer of Detroit Metal Spinning Co., Detroit, Mich., died recently.

Bernard E. Elshoff, 69, works manager Diehl Mfg. Co., division of the Singer Mfg. Co., Elizabeth, N. J., died Jan. 17 in Orlando, Fla., following a heart attack.

Personals

Joseph F. Heil, since 1931 vice-president of the Heil Company, Milwaukee, Wisc., has been elected executive vice-president of the company, and *George W. Kuhlman*, manager of the eastern factory at Hillside, N. J., has been elected vice-president.

After his graduation from Northwestern University, Mr. Heil, who is the son of Gov. J. P. Heil of Wisconsin, joined the Heil Company on a full time basis. He began at the bottom and worked up through the various departments of the company.

Mr. Kuhlman began his business career with the Heil Company in 1919, first working in the factory and later being transferred to the sales department. When the company expanded its factory branch activity, Mr. Kuhlman was placed in charge of the Philadelphia Branch and later of the New York office. He was next made eastern district manager and general manager of the eastern factory when that plant was acquired by the company.

Otto H. Loven, Ch.E. E.E., consulting plating engineer and chemist, has been appointed consultant for the Oriental Rouge Company, Bridgeport, Conn., where he will supervise analytical, chemical and research work.

Mr. Loven is well known in the plating field having published several papers and in recent years has specialized in the plating of hard chromium on tools and fixtures.

W. Roy Moore, for many years vice-president and secretary of the Billings & Spencer Company, has been named director of sales of the Peck, Stow & Wilcox Company, Southington, Conn. *William O. Seifert*, manager for many years of the machinery division, has been made sales manager of the newly amalgamated machinery and tools and hardware divisions. *Elmer J. Murray*, who has been traveling representative of the tools and hardware division, is now assistant sales manager. *Floyd J. Neal*, formerly manager of the tools and hardware division, is now manager of production.

John M. Spencer, President of the Hobart Manufacturing Company announced the appointment of *Burns H. Dreese* as General Manager, effective January 1, following action taken at a meeting of the Board of Directors, December 22.

Mr. Dreese has been Assistant General Manager since the first of 1938. He comes to his position well equipped through 20 years of experience with the Dayton Scale Co., and since 1934 with Hobart. He was Treasurer of the former company, and after acquisition by Hobart served as Manager of that Division.

H. T. Hershey of Proctor & Schwartz was chosen president of the Metal Manufacturers Association of Philadelphia. *R. F. Runge*, SKF Industries was elected vice-president; *H. W. Butterworth, Jr.*, H. W. Butterworth & Sons, treasurer; *C. E. Harrison*, American Engineering Co., *W. R. Hoyt*, Yale & Towne Mfg. Co., and *Clarence Tolan, Jr.*, Dodge Steel Co., were chosen as members of the board.

E. E. LeVan has been elected vice-president of Haynes Stellite Co., 205 E. 42nd St., N. Y. City, a unit of Union Carbide and Carbon Corporation. Mr. LeVan has been general sales manager and is located at the company's general office and works at Kokomo, Ind.

W. C. Stevens, vice-president in charge of engineering, *Cutler-Hammer, Inc.*, Milwaukee, Wisc., reports the promotions of *E. W. Seeger* to chief enginer and *P. B. Harwood* to assistant chief engineer. Mr. Seeger, who joined the firm in 1913, shortly after being graduated from Ohio State University, has been for several years assistant chief engineer. Mr. Harwood, with the firm since his graduation from Carnegie Institute of Technology in 1917, has been general engineering supervisor in recent years.

J. W. Robinson has been appointed as assistant manager of sales, Hot Rolled Products Department of the Jones & Laughlin Steel Corporation, Pittsburgh, Pa., having formerly been connected with the Detroit Sales Office of the corporation. A graduate of the University of Michigan, Mr. Robinson served in the U. S. Army during the World War and was first employed in 1920 in the Metallurgical Department of the Wills-St. Clair Company. In 1923 he went to the Packard Motor Car Co., as research metallurgist and in 1927 joined the sales force of the Higgins Bothwell Co. in Detroit. In 1934, Mr. Robinson became associated with the sales staff of the Jones & Laughlin Detroit office.

L. R. Kells has been appointed chief engineer for Salem Engineering Company, Salem, Ohio. Mr. Kells graduated from Ohio State University in 1914 and has been intimately associated with the industrial furnace industry for over twenty years.

George A. Burnham has resigned as assistant manager of the electrical department, in charge of switchgear sales and engineering division of the Condit works of the Allis-Chalmers Mfg. Co., Boston. He will be succeeded by *W. S. Edsall*, sales manager. Mr. Burnham will be retained in a consulting capacity. He was president of the American Brown Boveri Electric Co., Inc., and Condit Electrical Mfg. Corp., and after the purchase by Allis-Chalmers of certain electrical interests of the American Brown Boveri Electric Co., Inc., he continued as president and treasurer of the Condit Electrical Mfg. Corp., until January, 1937, when the Condit plant was operated as a branch of the Allis-Chalmers Mfg. Co.

Mr. Edsall, after conducting experimental work on submarine detection during the World War, entered the employ of the Sperry Gyroscope Co., and in 1920 he became identified with the Condit Electrical Mfg. Corp., becoming sales manager in 1922. When Allis-Chalmers purchased the company in 1931, Mr. Edsall continued his connection as manager of sales of the Condit works and later of the switchgear division.

C. W. Lugar has been appointed to the Indianapolis territory by the Wheelco Instruments Company, 1933 S. Halsted St., Chicago, Ill. Mr. Lugar will be located at 216 Indianapolis Terminal Warehouse, Indianapolis, Ind. He possesses a B.S. degree in mechanical engineering and has served as engineer in the Extension Service of the Purdue University on such subjects as high voltage research, television research and American Railway Association draft gear tests. He was recently connected with the Minneapolis Honeywell Company.

Arthur J. Williamson has been added to the technical staff of Summerill Tubing Company, Bridgeport, Pa., as metallurgical engineer in charge of research and development. After graduating from Lehigh University with a B. S. degree, Mr. Williamson continued his work and received his M.S. in metallurgy in 1933, staying on another year as laboratory assistant. His first commercial work was with J. G. Brill Co., Philadelphia, and during the last four years has been research metallurgist at John A. Roebling's Sons Co., Trenton, N. J.

Verified Business Items

Newly-Formed Udylite Corporation Acquires Bright Nickel Corporation

All the capital stock of the *Bright Nickel Corporation*, Detroit, Mich., owners of the basic Schloetter patents covering bright nickel plating process, has been acquired by the newly-formed *Udylite Corporation.*

Preceding the acquisition of the capital stock of the Bright Nickel Corporation, The Udylite Company formed a new organization to be known as The Udylite Corporation, which has taken over all of the business and assets of The Udylite Company. This company is one of the leading plating and polishing supply and equipment houses in the country.

The advantage of the Bright Nickel process results from materials coming from the tanks bright and shining, thereby eliminating buffing, with a consequent saving in time, labor and money.

The Bright Nickel Corporation will be operated as a wholly owned subsidiary of The Udylite Corporation.

The personnel and policies of The Udylite Corporation will remain the same as those of The Udylite Company, which it supersedes and the same management will continue. Officers of the new corporation are as follows: *Charles Awkermann*, chairman of the board; *L. K. Lindahl*, president; *C. H. Reeme*, vice-president; *Horace Maynard*, secretary.

The new corporation, through the acquisition of the Bright Nickel Corporation, can now offer the metal finishing industries a more complete range of products and processes, increased technical facilities as well as an organization equipped to handle a more rounded-out variety of metal finishing problems.

Risdon Manufacturing Co., Naugatuck, Conn., manufacturer of stamped metal products, wire goods, etc., has let general contract for a one-story addition, 40 x 130 ft. Cost over $40,000 with equipment. Departments: rolling, drawing, pickling, stamping, soldering, sand-blasting, descaling, polishing, degreasing, cleaning, plating, tumbling, burnishing, buffing, coloring, lacquering, enameling and finishing. Principal base metals used: brass, steel, bronze, nickel silver, zinc, aluminum.

Independent Air Filter Co., Inc., 228 N. La Salle St., Chicago, Ill., has decided to discontinue its business. The affairs of the company are now in liquidation and the process will be completed as rapidly as possible.

Adequate arrangements have been made to complete all outstanding orders and continue indefinitely all required service to customers having Independent equipment.

Lea Manufacturing Company, Waterbury, Conn., has been appointed New England distributors for *Maizo*, a product made by the Maizo Mills of Circleville, Ohio. Maizo is a platers' drying material which is said to combine the following characteristics: higher absorption properties than hard wood sawdust; free from dust; suitable for burnishing and all drying operations, including oil absorption in place of sawdust. Carload stock is carried by the Lea Manufacturing Company at its Waterbury warehouse.

Standard Steel Spring Company of Coraopolis, Pa., has opened a new electroplating plant especially designed to handle large sections of steel for finishing with a relatively pore-free type of nickel plating. These pore-free nickel coatings have been deposited up to twenty times the normal thicknesses used and they have demonstrated their resistance to corrosion in oil wells and the manufacturing of barrels, tanks and other containers for shipping and storing corrosive chemicals. A fellowship has been established at the Mellon Institute of Industrial Research to study the process and assure its scientific application to new fields of use.

Belke Manufacturing Company, 947 N. Cicero Ave., Chicago, Ill., have become Western distributors for the Cathanodic cleaning process, manufactured by *Frederick Gumm Chemical Company*, Kearny, N. J.

U. S. Stoneware Company, 60 E. 42nd Street, New York City, has changed the name of "Ruplastoids" to "Resilon."

The manufacturing plant and laboratories of the *Alrose Chemical Company* and *Mark Weisberg Laboratories* have recently been moved from their former Providence, R. I. locations, 80 Clifford St., and 92 Printery St., to a new enlarged factory at 180 Mill St., Cranston, R. I. The new plant, off Park Ave., has 40,000 sq. ft. of working space, with laboratories to accommodate 8 chemists.

The John P. Bonnett & Son Co., formerly owned by Mark Weisberg Laboratories, has been liquidated. Its operations in the electroplating of jewelry and novelties in precious metals have been discontinued, in order that increased emphasis may be given by Mark Weisberg Laboratories to research and the development of new specialties for the metal and textile trades. Development of several new finishes is contemplated, also improvements in all methods of electroplating so that the demands for new styles and colors may be met more satisfactorily by manufacturing jewelers.

At the new plant, a full line of synthetic chemicals for the textile industry, wetting agents, etc., will be produced as in the past—also the production of plating solutions for jewelers will be continued and enlarged. *Mark Weisberg* and *Frank K. Smith*, well known to the trade, are devoting their full time to the servicing and sales of equipment and special chemicals.

Among the many processes and plating solutions developed or produced by the Alrose Chemical Co. and Mark Weisberg Laboratories are: wetting agents, waterproofing compounds, printing gums; also Jetal, a simple immersion process which colors products of iron or steel to a lustrous, rich black finish; Rhodium, a hard, brilliant, durable white plate, highly reflective and untarnishable; White Gold No. 2, a lustrous, white, acid-proof finish for precious and base metals; Wite-Brass, a brilliant non-tarnishing white plate for all base and precious metals; Bon White, a silvery white, immersion finish for volume production of articles made of copper or brass or pre-plated with these metals; Gold Smut Base, a rich smut plated without the use of gold—provides an inexpensive base for all antique finishes.

The Alrose Chemical Company is offering free technical service on problems pertaining to the plating and finishing industry. Their new telephone numbers are Williams 3000 and 3001. A rapid delivery system is maintained for prompt servicing of the trade.

Diesel Engine Division, General Motors Corp., 13400 Outer Drive, Detroit, Mich., has let general contract for a one-story addition. Cost over $80,000 with equipment. The following departments are operated: grinding, sand-blasting, degreasing, cleaning, plating and coloring. Principal base metal used: steel.

Ault & Wiborg Corp., Dana Ave. and Montgomery Rd., Cincinnati, Ohio, manufacturers of industrial finishes, have let general contract for a one and three-story addition. Cost over $75,000 with equipment.

Revere Copper & Brass, Inc., Dallas Div., Chicago, Ill., announces the appointment of *Keith C. Bowers*, formerly of the St. Louis office, as its sales representative in Western Missouri and Kansas. Mr. Bowers will maintain headquarters at 325 Ward Parkway, Kansas City, Mo.

Electric Sprayit Company, and associated Moe-Bridges Corp., 220-228 N. Broadway, Milwaukee, Wisc., have taken 17-year lease on a factory building at Sheboygan, and will gradually transfer operations following modernization of Sheboygan plant, move to be completed about August 1st. Electric Sprayit Company founded at South Bend, Ind., to manufacture paint sprayers, purchased assets of Moe-Bridges Corp., manufacturing electric light fixtures in 1934, then combining operations in Milwaukee. The following departments are operated: pickling, spinning, stamping, soldering, brazing, welding, grinding, sand-blasting, polishing, degreasing, cleaning, plating, tumbling, burnishing, buffing, coloring, lacquering, enameling, finishing. Principal base metals used: brass, steel, bronze, zinc and aluminum.

Webster Manufacturing, Inc., Tiffin, Ohio, has succeeded the Webster Manufacturing Company and Weller Manufacturing Company. The company manufactures elevating, conveying, power transmission, chains, special machinery, sheet steel work, malleable and grey iron castings. Branch offices are in the following cities: Chicago, New York, Buffalo, Cincinnati, Cleveland, Detroit, Philadelphia, Pittsburgh, and Bloomington, Ill.

Francis R. Pyne has become associated with the Irvington Smelting and Refining Works, Irvington, N. J. as Assistant Superintendent.

Supply Prices, February 28, 1939

Anodes

Prices, except silver, are per lb. f.o.b., shipping point, based on purchases of 2,000 lbs. or more, and subject to changes due to fluctuating metal markets.

COPPER: Cast ..... 20⅞c. per lb.
Electrolytic, full size, 15⅞c.; cut to size 15⅞c. per lb.
Rolled oval, straight, 16⅜c.; curved .. 17⅜c. per lb.

BRASS: Cast ..... 17¾c. per lb.

ZINC: Cast ..... 10 c. per lb.

NICKEL: 90-92%, 16" and over ..... .45 per lb.
95-97%, 16" " " ..... .46 per lb.
99%+cast, 16" and over, 47c.; rolled, depolarized, 16" and over, 48c.

SILVER: Rolled silver anodes .999 fine were quoted Feb. 1, from 46c. per Troy ounce upward, depending on quantity.

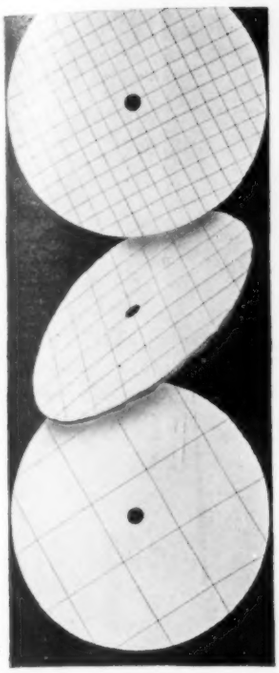
Chemicals

These are manufacturers' quantity prices and based on delivery from New York City.

Acetone, C.P. l.c.l., drums	lb.	.06¼
Acid, Boric (boracic) granular, 99.5%, bbls.	lb.	.053-.059
Chromic, 99%, 100 lb. and 400 lb. drums	lb.	.16¾-.17¼
Hydrochloric (muriatic) Tech., 20°, carboys	lb.	.027
Hydrochloric, C.P., 20°, carboys	lb.	.08
Hydrofluoric, 30%, bbls.	lb.	.07-.08
Nitric, 36°, carboys	lb.	.06
Nitric, 42°, carboys	lb.	.075
Oleic (Red Oil), distilled, drums	lb.	.08⅜
Oxalic, bbls. l.c.l.	lb.	.12-.14
Stearic, double pressed, distilled, bags	lb.	.10½-.11½
single pressed, bags	lb.	.10-.11
triple pressed bags	lb.	.13½-.14½
Sulphuric, 66°, carboys	lb.	.025
Alcohol, Amyl, l.c.l., drums	lb.	.14
Butyl-normal, l.c.l., drums	lb.	.095
Denatured, S.D. No. 1, 190 pf., bbls., works	gal.	.32
Diacetone, pure, drums, l.c.l.	lb.	.095
Methyl, (Methanol), 95%, drums, l.c.l.	gal.	.385
Propyl-Iso, 99%, l.c.l., drums	gal.	.41
Propyl-Normal, drums	gal.	.70
Alum, ammonia, granular, bbls., works	lb.	.032
Potash, granular, bbls., works	lb.	.034-.037
Ammonia, aqua, 26°, drums, carboys	lb.	.02¼-.05¼
Ammonium, chloride (sal-ammoniac), white, granular, bbls.	lb.	.05-.075
Sulphate, tech., bbls.	lb.	.035-.05
Sulphocyanide (thiocyanate), pure, crystal, kegs	lb.	.55-.58
Sulphocyanide (thiocyanate), com'l, drums	lb.	.16
Antimony Chloride (butter of antimony), sol., carboys	lb.	.13-.153
Barium Carbonate, ppted., l.c.l., bags, works	lb.	.03
Benzene (Benzol), pure, drums	gal.	.21
Butyl Lactate, drums	lb.	.225
Cadmium Oxide, l.c.l., bbls	lb.	.80
Calcium Carbonate (Ppted. chalk), U.S.P.	lb.	.05¾-.075
Carbon Bisulfide, l.c.l., 55 gal. drums	lb.	.05¾-.06
Carbon Tetrachloride, l.c.l., drums	gal.	.73
Chrome, green, commercial, bbls.	lb.	.21
Chromic Sulphate, drums	lb.	.26¼
Cobalt Sulphate, drums	lb.	.59
*Copper, Acetate (verdigris), bbls.	lb.	.25
Carbonate, 53/55%, bbls.	lb.	.155-.165
Cyanide, Tech., 100 lb. bbls.	lb.	.34
Sulphate, Tech., crystals, bbls.	lb.	.05
Cream of Tartar (potassium bitartrate), crystals, kegs	lb.	.20¼
Crocus Martis (iron oxide) red, tech., kegs	lb.	.07
Dibutyl Phthalate, l.c.l., drums	lb.	.195
Diethylene Glycol, l.c.l., drums, works	lb.	.17
Dextrine, yellow, kegs	lb.	.05-.08
Emery Flour (Turkish)	lb.	.07
Ethyl Acetate, 85%, l.c.l., drums	lb.	.066
Ethylene Glycol, l.c.l., drums, works	lb.	.17-.20
Flint, powdered	ton	30.00
Fluorspar No. 1 ground, 97-98%.	ton	$60.00
Fusel Oil, refined, drums	lb.	.125-.14
*Gold, Chloride	oz.	$18¼-23
Cyanide, potassium 41%	oz.	$15.45
Cyanide, sodium 46%	oz.	$17.10
Gum, Arabic, white, powder, bbls.	lb.	.125-.14
Sandarac, prime, bags	lb.	.50
Hydrogen Peroxide, 100 volume, carboys	lb.	.20
Iron Sulphate (Copperas), bbls.	lb.	.016
Lead, Acetate (Sugar of Lead), bbls.	lb.	.10-.12¾
Oxide (Litharge), bbls.	lb.	.125
Magnesium Sulphate (Epsom Salts), tech., bag	lb.	.018
Mercury Bichloride (Corrosive Sublimate)	lb.	$1.58
Mercuric Oxide, red, powder, drums	lb.	$1.71
Nickel, Carbonate, dry, bbls.	lb.	.36-.41
Chloride, bbls.	lb.	.18-.22
Salts, single, 425 lb. bbls.	lb.	.135-.145
Salts, double, 425 lb. bbls.	lb.	.135-.145
Paraffin	lb.	.05-.06
Phosphorus, red	lb.	.40-.44
yellow	lb.	.50
Potash, Caustic, 88-92%, flake, drums, works	lb.	.07¼-.075
Potassium, Bichromate, crystals, casks	lb.	.09¼
Carbonate (potash) 98-100%, drums	lb.	.06¾
Cyanide, 94-96%, cases	lb.	.525
Pumice, ground, bbls.	lb.	.03
Quartz, powdered	ton	$30.00
Quicksilver (Mercury) 76 lb. flasks	flask	$74.-$76.50
Rochelle Salts, crystals, bbls.	lb.	.18¼
Rosin, gum, bbls.	lb.	5.25-7.75
*Silver, Chloride, dry, 100 oz. lots	oz.	.40¼
Cyanide, 100 oz. lots	oz.	.39⅜
Nitrate, 100 oz. lots	oz.	.35
Sodium Carbonate (soda ash), 58%, bbls.	lb.	.0235
Cyanide 96%, 100 lb. drums	lb.	.15
Hydroxide (caustic soda) 76%, flake	lb.	.0355
Hyposulphite, crystals, bbls.	lb.	.035-.065
Metasilicate, granular, bbls.	lb.	.0315
Nitrate, tech., bbls.	lb.	.029
Phosphate, tribasic, tech., bbls.	lb.	.03
Pyrophosphate, anhydrous, bbls., l.c.l.	lb.	.0555
Sesquisilicate, drums	lb.	.0405
*Stannate, drums	lb.	.31½-.33½
Sulphate (Glauber's Salts), crystals, bbls., works	lb	.0135
Sulphocyanide, drums	lb.	.30-.35
Sulphur, Flowers, bbls., works	lb.	.037-.0419
*Tin Chloride, 100 lb. kegs	lb.	.36½
Toluene (Toluol), pure, drums, works	gal.	.27
Tripoli, powdered	lb.	.03
Wax, Bees, white, bleached, slabs 500 lbs.	lb.	.36-.37
Bees, yellow, crude	lb.	.21-.215
Carnauba, refined, bags	lb.	.35-.36
Montan, bags	lb.	.115-.12
Spermaceti, blocks	lb.	.23
Whiting, Bolted	lb.	.025-.06
Xylene (Xylol), drums, works	gal.	.31
Zinc, carbonate, bbls.	lb.	.14-.15
Cyanide, 100 lb. kegs	lb.	.33
Chloride, granular, drums	lb.	.06
Sulphate, crystals, bbls.	lb.	.04

*Subject to fluctuations in metal prices.

Metal prices on page 158.

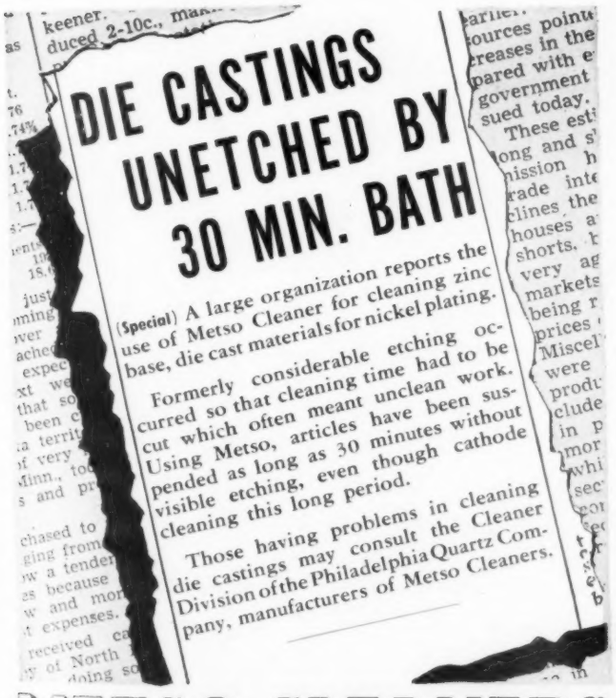


See How Much Money YOU Can Save . . .

PUT a Yerges buff to work on any job in your shop, from hardest, fastest cutting to softest buffing or polishing. See for yourself how much faster and better the Yerges buff does the work. Check the cost and see how much money the Yerges buff saves on that operation.

The extraordinary performance and long life of the Yerges buff are the result of our exclusive bias-cut, square-stitched construction. The buff presents an absolutely uniform face to the work throughout its entire diameter. Made for every requirement. Ask for samples and data. The Yerges Mfg. Company, Fremont, Ohio.

YERGES



DIE CASTINGS UNETCHED BY 30 MIN. BATH

(Special) A large organization reports the use of Metso Cleaner for cleaning zinc base, die cast materials for nickel plating.

Formerly considerable etching occurred so that cleaning time had to be cut which often meant unclean work. Using Metso, articles have been suspended as long as 30 minutes without visible etching, even though cathode cleaning this long period.

Those having problems in cleaning die castings may consult the Cleaner Division of the Philadelphia Quartz Company, manufacturers of Metso Cleaners.

METSO CLEANERS

PHILADELPHIA QUARTZ COMPANY

General Offices and Laboratory: 125 S. Third St., Phila., Pa.
Chicago Sales Office: 205 W. Wacker Drive. Stocks in 60 cities.
Sold in Canada by NATIONAL SILICATES LTD., Toronto, Ont.

Besplate

NICKEL ANODES

ARE QUALITY PRODUCTS . . .

LEADERS in the Nickel Plating Industry have standardized on McGean Besplate 99% Nickel Anodes — Because

1. Cathode Deposits are smoother
2. Anode corrosion is excellent
3. Less frequent filtering of solution required

◆◆◆◆◆

We Also Offer

Genuine Rolled Oval
Depolarized Nickel Anodes

◆◆◆◆◆

From our complete line of Anodes and Plating Chemicals we call your attention to the following:

ANODES

Nickel (all percentages)	Tin
Copper	Brass
Cadmium	Zinc

CHEMICALS

Nickel Salts	Copper Sulphate
Nickel Chloride	Copper Cyanide
Nickel Carbonate	Copper Carbonate
Chromic Acid	Cadmium Oxide

Manufactured by

THE McGEAN CHEMICAL COMPANY
CLEVELAND, OHIO

McGEAN CHEMICALS

Metal Prices, February 28, 1939

(All quotations are based on wholesale quantities, prompt delivery, New York unless otherwise specified.)

New Metals

Aluminum, Virgin ingot, 99% plus, c.l.	20.00c.
Antimony, Chinese, 99%	14.00c.
Bismuth, Ton lots, American, 99½%	$1.05
Cadmium, Sticks and bars, tons	.55c.
Copper, Lake, delivered Conn.	11.375c.
Electrolytic, delivered Conn.	11.25c.
Castings, F.O.B. refinery	10.15c.
Gold, U. S. Treasury price, oz. Troy	$35.00
Lead, Desilvered and Prime Western	4.60c.
Magnesium, 99.95% ingot	32.00c.
Mercury (Quicksilver), Flasks, 75 lb.	$93.00
Nickel, Ingot or Shot	36.00c.
Electrolytic, 99.95%, sheets	35.00c.
Platinum, oz., Troy	$35.00
Tin, Straits	45.70c.
Zinc, Prime Western	4.50c.
Brass Special	4.60c.
High Grade	5.50c.
Die Casting Alloy	7.50c.

Ingot Metals and Alloys

	Cents per lb.
No. 1 Yellow Brass	8.625
85-5-5-5	10.50
88-10-2	14.00
80-10-10	12.375
Manganese Bronze (60,000 t. s. min.)	10.625
Aluminum Bronze	14.875
Monel Metal Shot or Block	28
Nickel Silver (12% Ni)	12.625
Nickel Silver (15% Ni)	14.875
No. 12 Aluminum	12.00-14.25
Manganese Copper, Grade A (30%)	22-27
Phosphor Copper, 10%	15.00
Phosphor Copper 15%	15.50
Silicon Copper, 10%	21.50
Phosphor Tin, no guarantee	50-60
Iridium Platinum, 5% (Nominal)	$36.50
Iridium Platinum, 10% (Nominal)	$38.00

Old Metals

Dealers' buying prices, wholesale quantities:	Cents per lb.
Heavy copper and wire, mixed	7.125-7.375
Light copper	6.75-7.125
Heavy yellow brass	4.625-4.75
Light brass	3.75-3.875
No. 1 composition	6.625-6.875
No. 1 composition, turnings	6.25-6.50
Heavy soft lead	3.75-4.00
Old zinc	2.25-2.50
New zinc clips	2.75-3.00
Aluminum clips (new, soft)	13.00-13.25
Scrap aluminum, cast	6.50-6.75
Aluminum borings—turnings	5.00-5.25
No. 1 pewter	25.00-26.00
Electrotype	4.25-4.375
Nickel anodes	25.00-26.00
Nickel clips, new	27.00-28.00
Monel scrap	8.00-12.50

Wrought Metals and Alloys

The following are net BASE PRICES per lb., to which must be added extras for size, shape, quantity, packing, etc., or discounts, as shown in manufacturers' lists. Basic quantities on most rolled or drawn brass and bronze items below are from 2,000 to 5,000 lbs.; on nickel silver, from 1,000 to 2,000 lbs.

Copper Material

Sheet, hot rolled	19.375c.
Bare Wire, soft, less than carload	15.375c.
Seamless Tubing	19.875c.

Nickel Silver

Sheet Metal		Wire and Rod	
10% Nickel	25.00c.	10% Nickel	28.625c.
15% Nickel	27.375c.	15% Nickel	31.875c.
18% Nickel	28.375c.	18% Nickel	34.75c.

Aluminum Sheet and Coil

Base Prices Carload Lots (F.O.B. Mill)

Aluminum Sheet, 20 gauge	35.00c.
Aluminum Coils, 20 gauge	28.00c.

Rolled Nickel Sheet and Rod

Base Prices (F.O.B. Mill)

Cold Drawn Rods	50c.	Standard Cold Rolled Sheet	49c.
Hot Rolled Rods	45c.		

Monel Metal Sheet and Rod

Base Prices (F.O.B. Mill)

Hot Rolled Rods	35c.	No. 35 Sheets	37c.
Cold Drawn Rods	40c.	Std. Cold Rolled Sheets	39c.

Silver Sheet

Rolled Sterling Silver 45c. per Troy oz. upward according to quantity.

Brass and Bronze Meterial

	Yellow Brass	Red Brass 80%	Comm'l. Bronze
Sheet	17.31c.	18.25c.	19.37c.
Wire	17.56c.	18.50c.	19.62c.
Rod	12.62c.	18.50c.	19.62c.
Angles, channels, open seam tubing	25.75c.	26.75c.	27.88c.
Seamless tubing	20.06c.	20.90c.	21.77c.

Tobin Bronze and Muntz Metal

Tobin Bronze Rod	19.375c.
Muntz Metal Sheet	20.50c.
Muntz Metal Rod	16.625c.

Zinc and Lead Sheet

Zinc Sheet, carload lots standard sizes and gauges, at mill, less 7% discount	9.75c.
Zinc Sheet, 1200 lb. lots (jobbers' prices)	10.75c.
Zinc Sheet, 100 lb. lots (jobbers' prices)	14.75c.
Full Lead Sheet	7.75c.
Cut Lead Sheet	8.00c.

Block Tin, Pewter and Britannia Sheet

This list applies to either block tin or No. 1 Britannia Metal Sheet, No. 23 B. & S. Gauge, 18 inches wide or less; prices are all f.o.b. mill:

500 lbs. over	15c. above N. Y. pig tin price
100 to 500 lbs.	17c. above N. Y. pig tin price
Up to 100 lbs.	25c. above N. Y. pig tin price

Supply prices on page 156.